

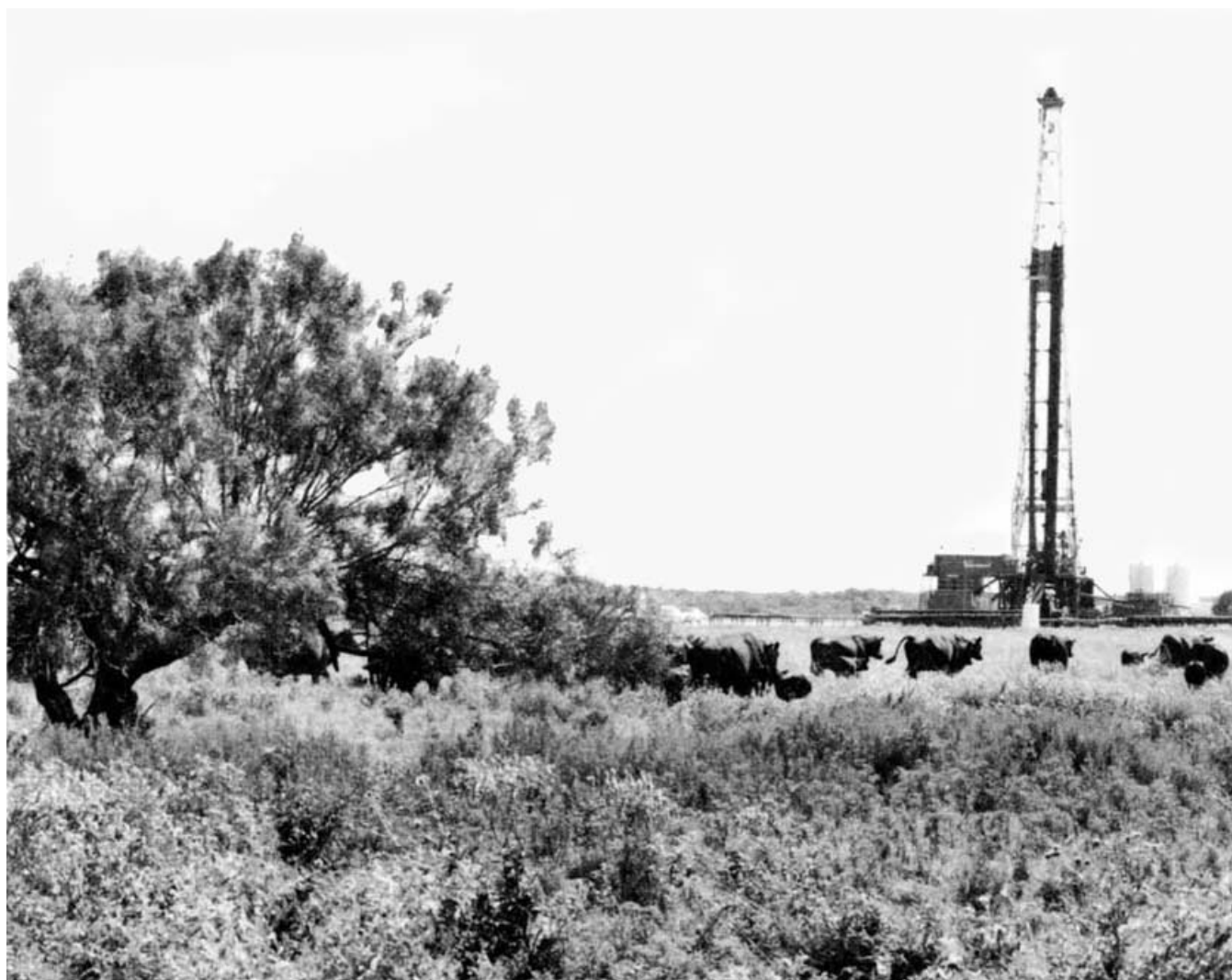


United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Texas Agricultural
Experiment Station

Soil Survey of Webb County, Texas

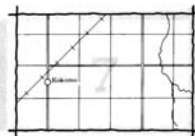
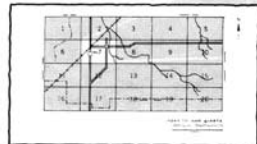


ELECTRONIC VERSION

This soil survey is an electronic version of the original printed copy, dated October 1985. It has been formatted for electronic delivery. Additional and updated information may be available from the Web Soil Survey. In Web Soil Survey, identify an Area of Interest (AOI) and navigate through the AOI Properties panel to learn what soil data is available.

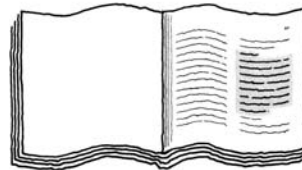
HOW TO USE THIS SOIL SURVEY

1. Locate your area of interest on the "Index to Map Sheets."



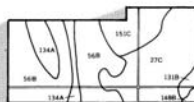
2. Note the number of the map sheet and turn to that sheet.

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.

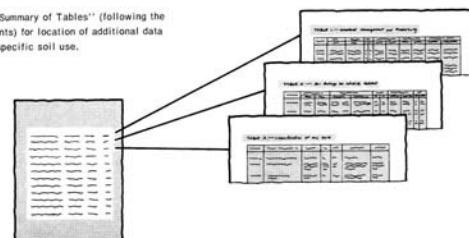


Map Unit	Page
134A	134
56B	135
151C	136
27C	137
131B	138
148B	139
151C	140

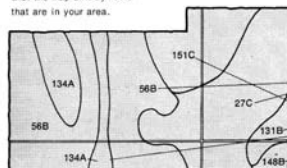
3. Locate your area of interest on the map sheet.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



4. List the map unit symbols that are in your area.



Symbols

27C
56B
131B
134A
148B
151C

7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Webb Soil and Water Conservation District. Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1982. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show small areas of contrasting soils that could have been shown at a larger scale.

Cover: Angus cattle grazing an area of Delmita loamy fine sand, 0 to 3 percent slopes. In the background, a gas well is being drilled. Cattle and petroleum products are important resources in Webb County

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AgB—Aguilares sandy clay loam, 0 to 3 percent slopes	17
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CfA—Catarina clay, occasionally flooded	22
CoB—Comitas fine sand, 0 to 3 percent slopes.....	22
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CRB—Cuevitas-Randado complex, gently undulating	23
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NDF—Nido-Rock outcrop complex, hilly.....	37
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Summary of Tables

*The tables listed below have been reformatted to accommodate file size and accessibility. The original tables along with the manuscript and maps are available on CD and paper copy. A copy can be obtained by contacting the Field office.

Note: The Soil Data Mart may provide more up-to-date tables for this survey area.

- Temperature and precipitation (table 1)
- Freeze dates in spring and fall (table 2)
Probability. Temperature.
- Growing season (table 3)
- Acreage and proportionate extent of the soils (table 4)
Acres. Percent.
- Rangeland productivity (table 5)
Range site. Potential annual production.
- Common and scientific names of range plants (table 6)
English name. Local or Spanish name. Scientific name.
- Recreational development (table 7)
*Camp areas. Picnic areas. Playgrounds. Paths and trails.
Golf fairways.*
- Building site development (table 8)
*Shallow excavations. Dwellings without basements.
Dwellings with basements. Small commercial buildings.
Local roads and streets. Lawns and landscaping.*
- Plants suitable for gardening and landscaping (table 9)
Flowers. Shrubs. Trees.
- Sanitary facilities (table 10)
*Septic tank absorption fields. Sewage lagoon areas.
Trench sanitary landfill. Area sanitary landfill.
Daily cover for landfill.*
- Construction materials (table 11)
Roadfill. Sand. Gravel. Topsoil.
- Water management (table 12)
*Limitations for—Pond reservoir areas; Embankments,
dikes, and levees. Features affecting—Drainage, Irrigation,
Terraces and diversions, Grassed waterways.*
- Engineering index properties (table 13)
*Depth. USDA texture. Classification—Unified, AASHTO.
Fragments greater than 3 inches. Percentage passing
sieve—4, 10, 40, 200. Liquid limit Plasticity index.*
- Physical and chemical properties of the soils (table 14)
*Depth. Clay. Moist bulk density. Permeability. Available
water capacity. Reaction. Salinity. Shrink-swell potential.
Erosion factors. Wind erodibility group. Organic matter.*
- Soil and water features (table 15)
*Hydrologic group. Flooding. High water table. Bedrock.
Cemented pan. Risk of corrosion.*
- Chemical and other analyses of selected soils (table 16)
*Calcium carbonate equivalent. Organic carbon. Cation
exchange capacity. pH. Electrical conductivity.
Exchangeable sodium percentage.*

Physical analyses of selected soils (table 17)

Particle-size distribution. Water content.

Engineering index test data (table 18)

Classification. Grain-size distribution. Liquid limit. Plasticity index. Specific gravity. Shrinkage.

Classification of the soils (table 19)

Family or higher taxonomic class

Foreword

This soil survey contains information that can be used in land-planning programs in Webb County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

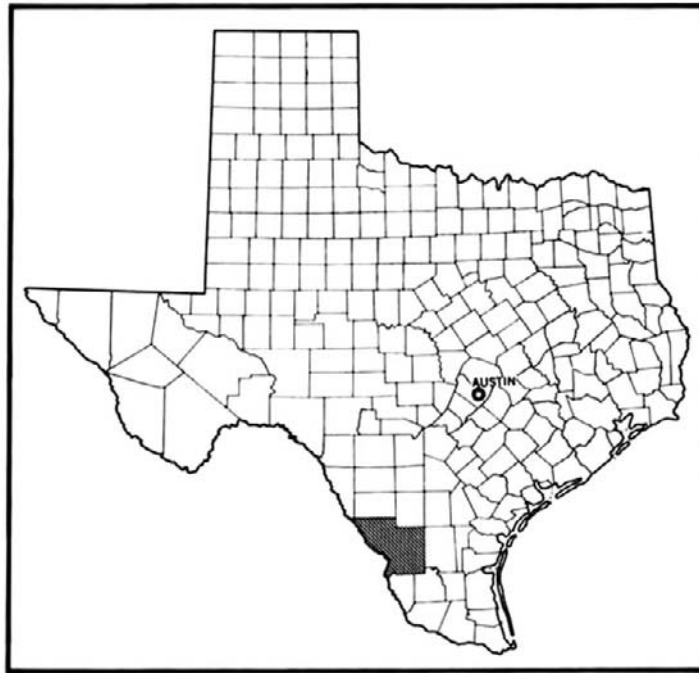
This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

A handwritten signature in cursive script that reads "Billy C. Griffin". The signature is written in black ink and is positioned above the printed name and title.

Billy C. Griffin
State Conservationist
Soil Conservation Service



Location of Webb County in Texas.

Soil Survey Of Webb County, Texas

By Russell R. Sanders and Wayne J. Gabriel,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Webb County is in the southern part of Texas. Its western boundary is the Rio Grande. The county is irregular in shape. It measures about 65 miles from north to south and 85 miles from east to west. It covers an area of 3,366 square miles, or 2,154,163 acres. Of this, 2,930 acres is water areas larger than 40 acres.

In 1980, the population of the county was about 100,000. Laredo, the county seat, has about 90,000 people and is growing rapidly. Other communities include Aguilares, Bruni, Mill's Bennett, Mirando City, and Oilton.

General Nature of the County

The county is in the Western Rio Grande Plain major land resource area. The land surface is nearly level to rolling. Elevations in the county range from 400 feet to about 900 feet above sea level. The average annual rainfall is 19.8 inches. The mean annual temperature is about 73°F. The growing season is about 300 days.

Webb County is primarily ranch country, and cattle ranching is the major agricultural enterprise in the county. Webb County is consistently one of the leading cow-calf producing counties in the state.

Leasing of ranches for hunting is another important enterprise in the county. White-tailed deer, javelina, dove, and quail are the major game species.

Vegetables, grain sorghum, cotton, and pasture grasses are grown using irrigation water from the Rio Grande.

In 1980, about 5,000 acres in the county was irrigated cropland or pasture, about 25,000 acres was urban or built-up land, and the remaining 2,124,163 acres was rangeland, wildlife habitat, roads, and water areas.

History

It is believed that Webb County was populated as early as 10,000 years ago. The original inhabitants were nomads who hunted for wild game, fished, and gathered fruits, nuts, berries, and seeds for food.

The community of Dolores was established in 1750. Laredo was established in 1755 by Jose de Escandon, governor of the Mexican state of Nuevo Santander. Laredo was named after the coastal city of Laredo, Spain. Webb County was established in 1848. The area had been part of Bexar County. It was named after James Webb, a leader of the Republic of Texas. In about 1850, Dolores was destroyed by Indians, and the county seat was moved to Laredo (6).

Laredo's first inhabitants raised livestock. They also grew corn, squash, chiles, melons, beans, and other vegetables for their own use. Colonial records reveal that, in most years, crop yields failed to provide enough food for all. Basic foods had to be bought and hauled by ox cart from towns in the interior of Mexico.

Raising sheep was the major agricultural enterprise in Webb County into the early 1900's. Government officials and military men often cited the importance of sheep. Horses, mules, donkeys, goats, and cattle were raised in lesser numbers. Cattle production replaced sheep raising as the main agricultural activity in the 20th century.

The coming of the railroad in 1881 resulted in the rapid economic growth of Laredo. The first railroad connected Laredo with all of the major rail systems in the

United States. In 1888, National Railways of Mexico completed the rail line that connected Laredo and Nuevo Laredo with Mexico City.

In the 1880's, a bridge was built across the Rio Grande to accommodate pedestrians, wagons, and streetcars. Before that bridge and the railroad bridge were built, people and goods crossed the river by ferry. Bridges established Laredo as a major port of entry into Mexico.

Commercial crop production began in the 1890's after the railroads provided transportation to markets. Cotton, onions, and other vegetables were the main irrigated crops. Some dryland cotton was grown, but poor rainfall distribution in the county made it a marginal enterprise. After World War II, vegetable growers in the county found it difficult to compete with growers in other areas. Even in the heyday of crop production, the amount of land in crops never exceeded 1 percent of the acreage in Webb County.

After World War II, buffelgrass was introduced in Webb County. Buffelgrass has since become the preferred grass for range reseeding in most of the county.

Coal production was an important source of employment from the 1880's to 1939, when coal production was suspended. Natural gas was discovered in Webb County in 1908, and oil was discovered in 1921 at Mirando City. Coal began to be mined again in the 1970's near the ghost town of Palafox. Uranium production began in the southeastern part of the county in 1975.

The Webb Soil and Water Conservation District was organized in 1951. Area ranchers and farmers joined together to encourage the conservation of soil, water, plants, wildlife, and recreational resources.

Transportation

Webb County is served by Interstate Highway 35, by U.S. Highways 59 and 83, and by Texas Highways 44 and 359. Numerous farm-to-market roads and county roads also traverse the county.

Laredo is a major distribution center for goods moving between the United States and Mexico. Two highway bridges and one railroad bridge cross the Rio Grande at Laredo (fig. 1).



Figure 1.—The International bridge across the Rio Grande is a major link between Laredo and Nuevo Laredo and Mexico. The soil adjacent to the river is Rio Grande very fine sandy loam, occasionally flooded.

Two railroad lines, the Missouri Pacific Railroad and the Texas Mexican Railway, connect Laredo with other cities in the United States and Mexico.

Airlines at the Laredo International Airport connect Laredo with San Antonio and the rest of the world.

Climate

Except for the precipitation data, the climatic data for Webb County were prepared by the National Climatic Center, Asheville, North Carolina.

Summers in Webb County are hot. Winters are fairly warm. Cold spells and snow are rare. Rains are usually heaviest late in spring and early in fall. Rain in the fall is often associated with a dissipating tropical storm. Total annual precipitation is usually adequate for range vegetation, but often is not adequate for cotton, small grains, and sorghum, because of the high rate of evapotranspiration.

Table 1 gives data on temperature and precipitation for Webb County. The data, recorded at Laredo, Texas, cover the period 1965-78. Table 1 also gives data on precipitation for the period 1931-79. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 58°F, and the average daily minimum temperature is 46°F. The lowest temperature on record, which occurred at Laredo on December 21, 1973, is 16°F. In summer the average temperature is 85°F, and the average daily maximum temperature is 97°F. The highest recorded temperature, which occurred on May 26, 1973, is 109°F.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50°F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 14 inches, or 70 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 9 inches. Thunderstorms occur on about 40 days each year, and most occur in summer.

Snowfall is rare; in 85 percent of the winters there is no measurable snowfall. In 15 percent, the snowfall, usually of short duration, is more than 2 inches. The heaviest 1-day snowfall on record was more than 2 inches.

The average relative humidity in mid afternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 percent in summer and 50 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 11 miles per hour, in spring.

Trade and Industry

Energy production, trade with Mexico, tourism, and construction are some of the most important nonagricultural enterprises in Webb County.

Natural gas, oil, coal, and uranium production have developed and expanded rapidly in recent years. These and related industries have contributed greatly to economic growth in the county.

In recent years, Laredo has been one of the fastest growing cities in the state of Texas. Laredo, because of its border location, its transportation network, and its warehousing and retail trade facilities, has developed into a major center for trade with Mexico. Manufactured goods and agricultural products from both the United States and Mexico cross the border daily.

Laredo's mild climate and its proximity to Mexico attract tourists year round. Lake Casa Blanca, just outside of Laredo, is a favored spot for sport fishing and other types of recreation.

The population growth and economic expansion of the area have caused rapid growth in the construction industry in Laredo and surrounding areas of the county. Construction in the past few years has included manufacturing plants, hotels, motels, banks, warehouses, single family dwellings, townhouses, condominiums, stores, mobile home parks, roads, streets, and water and sewage facilities.

Natural Resources

Soil and water are the two most important natural resources in Webb County. Oil, natural gas, coal, uranium, and barite are other important natural resources in the county. Also, sand, gravel, clay, and caliche are available and are used extensively in the construction of roads and buildings.

The Rio Grande supplies water for Laredo and the Del Mar Conservation District. It also supplies water for irrigation of crops and pastures. Lake Casa Blanca and many other manmade bodies of water throughout the county provide water for livestock, wildlife, and recreation.

Supplies of good quality ground water are limited in the county. Some aquifers in the county supply suitable water for domestic use, livestock use, or irrigation, but most of the ground water is too saline for these uses.

The rangeland in the county produces forage for both livestock and wildlife. The grass and brush cover on rangeland help protect the soil from water and wind erosion. Much of the rangeland in the county has the potential to produce more forage than it does today. Management practices that increase the amount of vegetative cover on the land also increase the rate of water infiltration, thereby reducing runoff and soil erosion. The result is better use of rainfall, higher forage yields, and reduced flooding in low-lying areas.

How This Survey Was Made

Most of Webb County is rangeland; thus, much of the county was mapped as broadly defined units. About 36,000 acres along the Rio Grande was mapped in more detail to provide soil survey information on present and potential irrigated cropland. Most of the map units in this area are narrowly defined.

Some of the delineations of soils in Webb County do not match those on soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. The differences are a result of improvements in the classification of soils, particularly modification or refinements in soil series concepts. Also, there may be differences in the intensity of mapping or in the extent of the soils within the survey area.

A soil survey of the Laredo area was published in 1906 (11). That survey is no longer available.

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

Soil Classification and Soil Mapping

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil

scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States, presented in *Soil Taxonomy* (14), is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Variability and Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and

management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

Confidence Limits of Soil Survey Information

The statements about soil behavior in this survey can be thought of in terms of probability: they are predictions of soil behavior. The behavior of a soil depends not only on its own properties but on responses to such variables as climate and biological activity. Soil conditions are predictable for the long term, but they are unpredictable from year to year. For example, a soil scientist can state that a given soil has a high water table in most years, but the scientist cannot say with certainty that the water table will be present next year.

Confidence limits of soil surveys are statistical expressions of the probability that the composition of a map unit or a property of the soil will vary within prescribed limits. Confidence limits can be assigned numerical values based on a random sample. In the absence of specific data to determine confidence limits, the natural variability of soils and the way soil surveys are made must be considered. The composition of map units and other information is derived largely from extrapolations made from a small sample. The map units contain contrasting inclusions. Also, information about the soils does not extend below a depth of 5 or 6 feet. The information presented in the soil survey is not meant to be used as a substitute for onsite investigations. Soil survey information can be used to select from among alternative practices or general designs that may be needed to minimize the possibility of soil-related failures. It cannot be used to interpret specific points on the landscape.

Specific confidence limits for the composition of the broadly defined map units in Webb County were determined by taking samples from random transects made across mapped areas. The sample data were statistically summarized. Soil scientists made enough transects and took enough samples to characterize the delineated associations and complexes at an 80 percent confidence level. This means, for example, that in 80 percent of the areas mapped as Maverick-Catarina complex, gently rolling, the percentage of the soils will be within the range given in the map unit description. In as many as 20 percent of the mapped areas of this complex, the percentage of any of the soils can be either higher or lower than the given range.

The composition of the narrowly defined map units in this survey is based on the judgment of the soil scientist and was not determined by a statistical procedure.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more

major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. In this section each map unit is rated for crops, urban uses, and wildlife habitat. Urban uses include residential, commercial, and industrial developments. Ratings and soil limitations are for the map unit as a whole.

Soil Descriptions

1. Montell-Moglia-Viboras

Deep and moderately deep, nearly level to gently sloping, saline, clayey and loamy soils

The landscape consists of low hills and broad plains separated by broad valleys. Montell soils are in broad and narrow valleys along drainageways and on smooth plains. Moglia soils are on convex plains and on the summit and side slopes of low hills. Viboras soils are on broad, smooth plains and in valleys.

This map unit makes up about 19.2 percent of the county. The composition is about 46 percent Montell soils, 20 percent Moglia soils, and 11 percent Viboras soils. The remaining 23 percent is Aguilares, Brundage, Brystal, Catarina, Copita, Duval, Jimenez, Maverick, and Quemado soils.

Montell soils are deep, moderately well drained, and very slowly permeable. Typically, these soils have a gray, calcareous clay surface layer about 12 inches thick. The next layer, from 12 to 28 inches, is gray, saline, calcareous clay. From 28 to 60 inches, the soil is pale brown, saline, calcareous clay.

Moglia soils are deep, well drained, and moderately slowly permeable. Typically, these soils have a grayish brown, calcareous clay loam surface layer about 7 inches thick. The upper part of the subsoil, from 7 to 21 inches, is pale brown, saline, calcareous clay. The lower part of the subsoil, from 21 to 30 inches, is very pale brown, saline, calcareous clay loam. The underlying layer, from 30 to 60 inches, is pink, saline, calcareous loam that grades to clay loam in the lower part.

Viboras soils are moderately deep, moderately well drained, and very slowly permeable. Typically, these soils have a clay surface layer about 9 inches thick that is brown and noncalcareous in the upper part and reddish brown and calcareous in the lower part. The subsoil, from 9 to 28 inches, is reddish brown, saline, calcareous clay. The underlying layer to a depth of 60 inches is reddish brown, saline, calcareous, fractured siltstone and shaly clay.

The soils making up this map unit are used as rangeland and habitat for wildlife. They are not suited to use as cropland because of salinity and the low rainfall in the area.

The soils are poorly suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, corrosivity to uncoated steel, low soil strength affecting local roads and streets, and moderately slow to very slow permeability are the main limitations. Occasional flooding is a hazard on Montell soils in valleys along drainageways.

The soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

2. Catarina-Maverick-Palafox

Deep and moderately deep, nearly level to gently rolling, saline and nonsaline, clayey and loamy soils

The landscape consists of hills and broad plains separated by broad valleys. Catarina soils are in broad and narrow valleys along drainageways and on smooth plains. Maverick soils are on the summit and side slopes of hills that are dissected by small drainageways. The Palafox soils are on broad, slightly convex plains, foot slopes of hills, and smooth plains parallel to valleys (fig. 2).

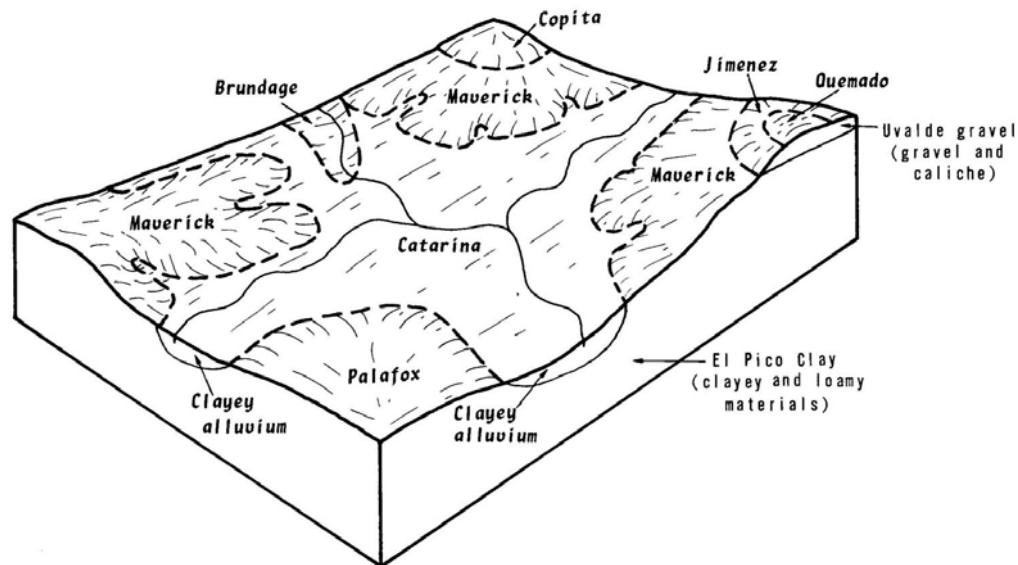


Figure 2.—Typical pattern of soils in the Catarina-Maverick-Palafox map unit.

This map unit makes up about 18.2 percent of the county. The composition is about 40 percent Catarina soils, 30 percent Maverick soils, and 17 percent Palafox soils. The remaining 13 percent is Brundage, Brystal, Copita, Jimenez, Montell, Quemado, and Tela soils.

Catarina soils are deep, moderately well drained, and very slowly permeable. Typically, these soils have a light brownish gray, calcareous clay surface layer about 14 inches thick. The subsoil, from 14 to 96 inches, is saline, calcareous clay. The upper part is pale brown, and the lower part is very pale brown.

Maverick soils are moderately deep, well drained, and slowly permeable.

Typically, these soils have a grayish brown, calcareous clay surface layer about 6 inches thick. The subsoil, from 6 to 25 inches, is saline, calcareous clay. The upper part is light olive brown, and the lower part is pale olive. The underlying layer to a depth of 60 inches is pale yellow, saline, calcareous, fractured shaly clay.

Palafox soils are deep, well drained, and moderately slowly permeable. Typically, these soils have a brown, calcareous clay loam surface layer about 12 inches thick. The upper part of the subsoil, from 12 to 28 inches, is brown, calcareous clay loam. The middle part, from 28 to 34 inches, is yellowish brown, calcareous clay loam. The lower part of the subsoil, from 34 to 45 inches, is light yellowish brown, saline, calcareous clay loam. The underlying layer to a depth of 72 inches is light yellowish brown, saline, calcareous clay loam.

The soils making up this map unit are used as rangeland and as habitat for wildlife. The soils are not suited to use as cropland because of low rainfall and salinity.

The soils are poorly suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, corrosivity to uncoated steel, low strength affecting local roads and streets, and moderately slow to very slow permeability are the main limitations. Occasional flooding is a hazard in some areas of Catarina soils in valleys along drainageways.

The soils are only moderately well suited to use as wildlife habitat because of insufficient cover. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove.

3. Catarina-Maverick-Moglia

Deep and moderately deep, nearly level to gently rolling, saline, clayey and loamy soils

The landscape consists of hills and broad plains separated by broad valleys. Catarina soils are in broad and narrow valleys along drainageways and on smooth plains. Maverick soils are on the summit and side slopes of hills that are dissected by small drainageways. The Moglia soils are on convex plains and on the summit and side slopes of low hills.

This map unit makes up about 12.2 percent of the county. The composition is about 36 percent Catarina soils, 23 percent Maverick soils, and 17 percent Moglia soils. The remaining 24 percent is Brundage, Copita, Jimenez, Nido Variant, Quemado, Tela, and Viboras soils.

Catarina soils are deep, moderately well drained, and very slowly permeable. Typically, these soils have a light yellowish brown, calcareous clay surface layer about 12 inches thick. The next layer, from 12 to 60 inches, is light yellowish brown, saline, calcareous clay.

Maverick soils are moderately deep, well drained, and slowly permeable. Typically, these soils have a grayish brown, calcareous clay surface layer about 6 inches thick. The subsoil, from 6 to 25 inches, is saline, calcareous clay. The upper part is light olive brown, and the lower part is pale olive. The underlying layer to a depth of 60 inches is pale yellow, saline, calcareous, fractured shaly clay.

Moglia soils are deep, well drained, and moderately slowly permeable. Typically, these soils have a grayish brown, calcareous clay loam surface layer about 7 inches thick. The upper part of the subsoil, from 7 to 21 inches, is pale brown, saline, calcareous clay. The lower part, from 21 to 30 inches, is very pale brown, saline, calcareous clay loam. The underlying layer to a depth of about 60 inches is pink, saline, calcareous loam grading to clay loam.

The soils are used as rangeland and as habitat for wildlife. They are not suited to use as cropland because of low rainfall and salinity.

The soils are poorly suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, corrosivity to uncoated steel, low strength affecting local roads and streets, and moderately slow to very slow permeability are the main limitations. Occasional flooding is a hazard on Catarina soils in valleys along drainageways.

The soils are moderately well suited to wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

4. Duval-Brystal

Deep, nearly level to gently sloping, nonsaline, loamy soils

The landscape consists of low hills and broad plains separated by narrow valleys. Duval soils are on summits and side slopes of low hills and on broad convex plains. Brystal soils are on side slopes of low hills and on smooth plains parallel to valleys.

This map unit makes up about 11.3 percent of the county. The composition is about 48 percent Duval soils and 29 percent Brystal soils. The remaining 23 percent is Brundage, Copita, Cuevitas, Dilley, Hebbronville, Moglia, Randado, Tela, and Zapata soils.

Duval soils are deep, well drained, and moderately permeable. Typically, these soils have a reddish brown fine sandy loam surface layer about 14 inches thick. The subsoil from 14 to 22 inches is reddish brown fine sandy loam. From 22 to 56 inches, it is red sandy clay loam in the upper part and yellowish red sandy clay loam in the lower part. The underlying layer to a depth of 62 inches is yellowish red sandstone.

Brystal soils are deep, well drained, and moderately permeable. Typically, these soils have a brown fine sandy loam surface layer about 12 inches thick. The subsoil from 12 to 23 inches is yellowish red sandy clay loam. From 23 to 63 inches, it is calcareous sandy clay loam that is yellowish red in the upper part and reddish yellow in the lower part.

The soils in this map unit are used as rangeland and as habitat for wildlife. They are poorly suited to use as cropland because of low rainfall. These soils are well suited to irrigated crops if a source of water is available.

The soils are well suited to most urban uses.

The soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

5. Aguilares-Montell

Deep, nearly level to gently sloping, nonsaline and saline, loamy and clayey soils

The landscape consists of broad plains and low hills separated by broad valleys. Aguilares soils are on broad, convex plains. Montell soils are in broad and narrow valleys along drainageways and on smooth plains (fig. 3).

The map unit makes up about 9.6 percent of the county. The composition is about 48 percent Aguilares soils and 23 percent Montell soils. The remaining 29 percent is Arroyada, Brundage, Catarina, Jimenez, Maverick, Nido Variant, Quemado, and Viboras soils.

Aguilares soils are deep, well drained, and moderately permeable. Typically, these soils have a grayish brown, calcareous sandy clay loam surface layer about 8 inches thick. The upper part of the subsoil, from 8 to 13 inches, is light brownish gray, calcareous clay loam. The lower part of the subsoil, from 13 to 36 inches, is pale brown, calcareous clay loam. The underlying layer to a depth of 72 inches is very pale brown, saline, calcareous sandy clay loam that has weakly cemented sandstone fragments in the lower part.

Montell soils are deep, moderately well drained, and very slowly permeable. Typically, these soils have a gray, calcareous clay surface layer about 12 inches thick. The next layer, from 12 to 28 inches, is gray, saline, calcareous clay. From 28 to 60 inches, the soil is pale brown, saline, calcareous clay.

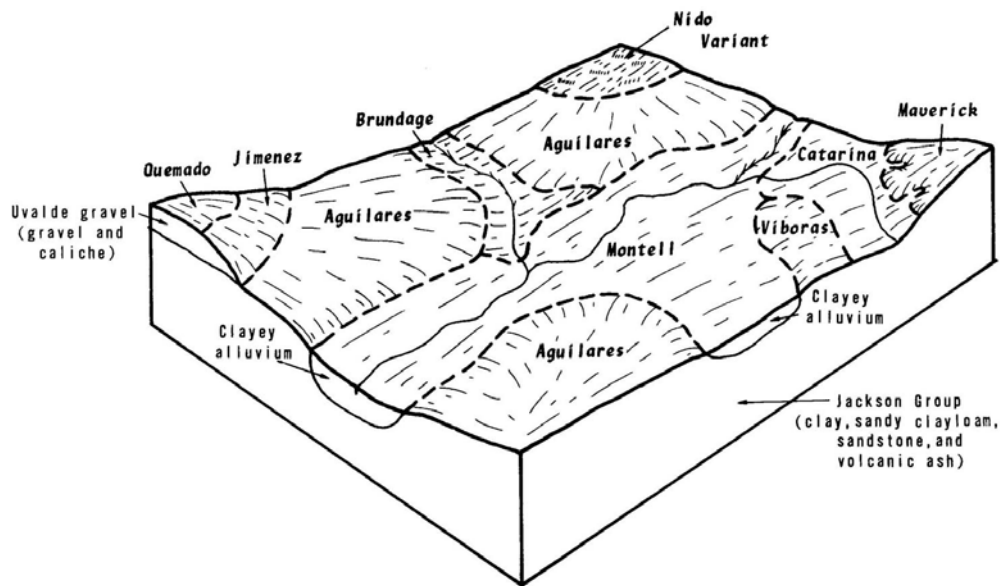


Figure 3.—Typical pattern of soils in the Aguilares-Montell map unit.

The soils are used as rangeland and as habitat for wildlife. They are poorly suited to use as cropland because of low rainfall.

The soils are moderately well suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, corrosivity to uncoated steel, low strength affecting local roads and streets, and moderate to very slow permeability are the main limitations. Occasional flooding is a hazard on Montell soils in valleys along drainageways.

The soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

6. Hebbronville-Brundage-Copita

Deep and moderately deep, nearly level to gently sloping, nonsaline and saline, sandy and loamy soils

The landscape consists of broad plains and low hills separated by narrow valleys. Hebbronville soils are on broad, convex plains. Brundage soils are in valleys along small drainageways and on smooth plains parallel to drainageways. Brundage soils are occasionally flooded. Copita soils are on the summit and side slopes of low hills and on broad convex plains.

This map unit makes up about 8.9 percent of the county. The composition is about 43 percent Hebbronville soils, 20 percent Brundage soils, and 15 percent Copita soils. The remaining 22 percent is Aguilares, Catarina, Comitas, Maverick, Nido Variant, Nueces, and Tela soils.

Hebbronville soils are deep, well drained, and moderately rapidly permeable. Typically, these soils have a grayish brown loamy fine sand surface layer about 4 inches thick. The next layer, from 4 to 16 inches, is grayish brown fine sandy loam. The subsoil, from 16 to 46 inches, is calcareous fine sandy loam that is brown in the upper part and yellowish brown and light yellowish brown in the lower part. The underlying layer, from 46 to 60 inches, is very pale brown, calcareous sandy clay loam.

Brundage soils are deep, moderately well drained, and very slowly permeable. Typically, these soils have a brown fine sandy loam surface layer about 5 inches thick. The upper part of the subsoil, from 5 to 15 inches, is brown, saline sandy clay loam. The middle part, from 15 to 30 inches, is yellowish brown, saline calcareous,

sandy clay loam. The lower part of the subsoil, from 30 to 46 inches, is light yellowish brown, saline, calcareous sandy clay loam. The underlying layer, from 46 to 60 inches, is brownish yellow, saline, calcareous sandy clay loam.

Copita soils are moderately deep, well drained, and moderately permeable. Typically, these soils have a brown, calcareous, fine sandy loam surface layer about 9 inches thick. The subsoil, from 9 to 37 inches, is calcareous sandy clay loam that is yellowish brown in the upper part and light yellowish brown in the lower part. The underlying layer to a depth of 60 inches is pale yellow, calcareous sandstone.

The soils making up this map unit are used as rangeland and as habitat for wildlife. They are poorly suited to use as cropland because of low rainfall.

The soils are well suited to most urban uses. The depth to sandstone on Copita soils, and the very slow permeability and salinity of Brundage soils are the main limitations. Occasional flooding is a hazard on the Brundage soils.

The soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

7. Copita-Verick

Moderately deep and shallow, nearly level to gently sloping, nonsaline, loamy soils

The landscape consists of broad plains and low hills separated by narrow valleys. Copita soils are on broad, convex plains and on the summit and side slopes of low hills. Verick soils are on the summit and side slopes of low hills (fig. 4).

This map unit makes up about 8 percent of the county. The composition is about 55 percent Copita soils and 18 percent Verick soils. The remaining 27 percent is Brystal, and Tela soils.

Copita soils are moderately deep, well drained, and moderately permeable. Typically, these soils have a brown, calcareous fine sandy loam surface layer about 9 inches thick. The subsoil, from 9 to 37 inches, is calcareous sandy clay loam that is yellowish brown in the upper part and light yellowish brown in the lower part. The underlying layer to a depth of 60 inches is pale yellow, calcareous sandstone.

Verick soils are shallow, well drained, and moderately permeable. Typically, these soils have a yellowish brown, calcareous fine sandy loam surface layer about 9 inches thick. The subsoil, from 9 to 15 inches, is light yellowish brown, calcareous fine sandy loam. The underlying layer to a depth of 60 inches is light yellowish brown sandstone.

The soils are used mainly as rangeland and as habitat for wildlife. They are not suited to use as cropland because of the low rainfall in the area. In a few small areas close to the Rio Grande, the soils are used for irrigated vegetables and for irrigated pasture.

The soils are moderately well suited to most urban uses. Corrosivity to uncoated steel and shallowness to sandstone are the main limitations.

These soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

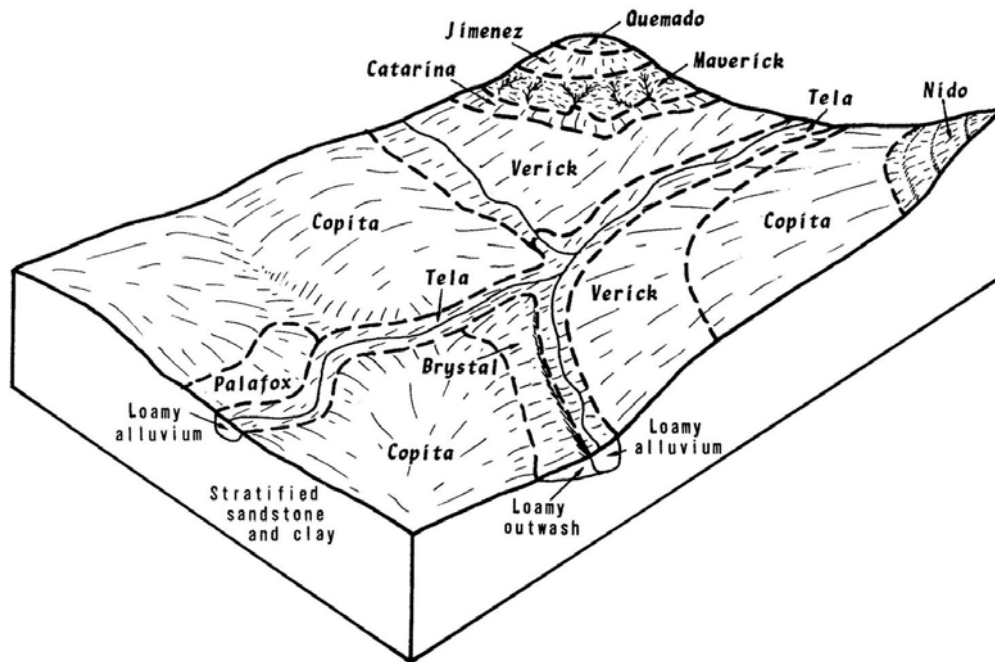


Figure 4.—Typical pattern of soils in the Copita-Verick map unit.

8. Delmita-Randado-Cuevitas

Moderately deep to very shallow, gently undulating, nonsaline, sandy and loamy soils

The landscape consists of broad plains separated by narrow valleys. Shallow, rounded depressions or lagunas are scattered over the landscape. Delmita soils are in the smoother areas (fig. 5).

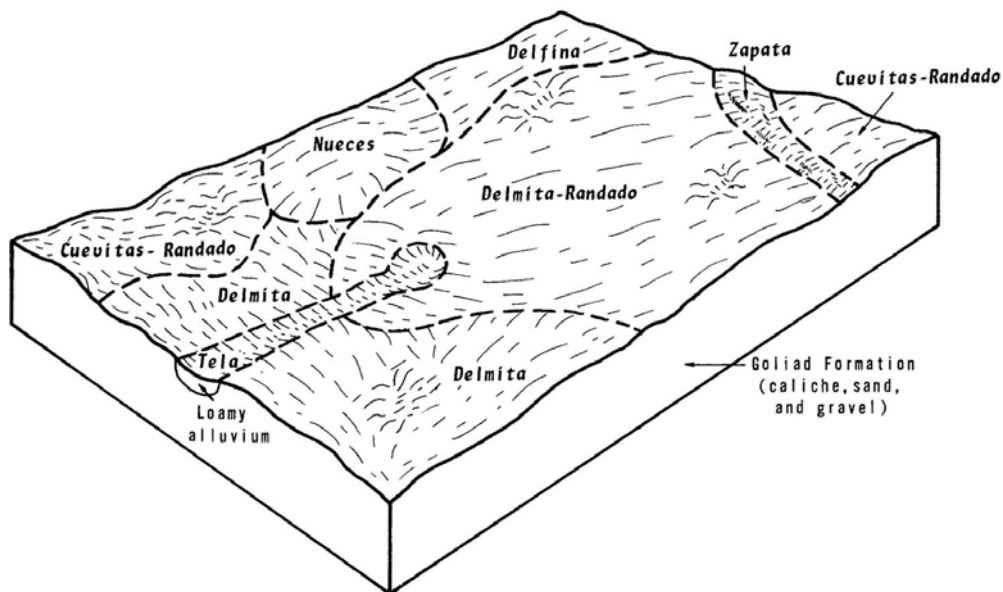


Figure 5.—Typical pattern of soils in the Delmita-Randado-Cuevitas map unit.

This map unit makes up about 7 percent of the county. The composition is about 32 percent Delmita soils, 30 percent Randado soils, and 21 percent Cuevitas soils. The remaining 17 percent is Delfina, Hebbronville, Nueces, Tela, and Zapata soils.

Delmita soils are moderately deep, well drained, and moderately permeable. Typically, these soils have a reddish brown loamy fine sand surface layer about 12 inches thick. The upper part of the subsoil, from 12 to 22 inches, is red fine sandy loam. The lower part of the subsoil, from 22 to 34 inches, is red sandy clay loam. The underlying layer, from 34 to 36 inches, is strongly cemented caliche. The next layer to a depth of 60 inches is weakly cemented caliche.

Randado soils are shallow, well drained, and moderately permeable. Typically, these soils have a reddish brown loamy fine sand surface layer about 9 inches thick. The subsoil, from 9 to 18 inches, is reddish brown fine sandy loam. The underlying layer, from 18 to 23 inches, is strongly cemented caliche. The next layer to a depth of 60 inches is weakly cemented caliche.

Cuevitas soils are very shallow, well drained, and moderately permeable. Typically, these soils have a fine sandy loam surface layer, about 9 inches thick, that is brown in the upper part and reddish brown in the lower part. The underlying layer, from 9 to 16 inches, is strongly cemented caliche. The next layer to a depth of 60 inches is weakly cemented caliche.

The soils making up this map unit are used mainly as rangeland and habitat for wildlife. In some areas the soils are a source of caliche for use in road construction.

The soils are poorly suited to use as cropland because of shallowness and the low rainfall in the area.

The soils are poorly suited to most urban uses. Shallowness to the strongly cemented pan is the main limitation.

These soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

9. Maverick-Jimenez-Quemado

Moderately deep to very shallow, undulating to gently rolling, saline and nonsaline, clayey and very gravelly, loamy soils

The landscape consists of hills and ridges separated by narrow valleys. Maverick soils are on the summit and side slopes of hills. Jimenez and Quemado soils are on the summit and side slopes of hills and ridges.

This map unit makes up about 2.3 percent of the county. The composition is about 25 percent Maverick soils, 25 percent Jimenez soils, and 23 percent Quemado soils. The remaining 27 percent is Catarina, Copita, Palafox, Tela, and Verick soils.

Maverick soils are moderately deep, well drained, and slowly permeable. Typically, these soils have a grayish brown, calcareous clay surface layer about 6 inches thick. The subsoil, from 6 to 25 inches, is saline, calcareous clay. The upper part is light olive brown, and the lower part is pale olive. The underlying layer to a depth of 60 inches is pale yellow, saline, calcareous, fractured shaly clay.

Jimenez soils are very shallow and shallow, well drained, and moderately permeable. Typically, these soils have a calcareous, very gravelly sandy clay loam surface layer about 13 inches thick. The upper 9 inches is dark brown, and the lower 4 inches is brown. The underlying layer, from 13 to 25 inches, is strongly cemented caliche. The next layer to a depth of 60 inches is very gravelly, weakly cemented caliche.

Quemado soils are shallow, well drained, and moderately permeable. Typically, these soils have a reddish brown, very gravelly sandy loam surface layer about 6 inches thick. The subsoil, from 6 to 12 inches, is reddish brown, very gravelly sandy

clay loam. The underlying layer, from 12 to 14 inches, is strongly cemented caliche. The next layer to a depth of 60 inches is very gravelly, weakly cemented caliche.

The soils in this map unit are used mainly as rangeland and habitat for wildlife. In some areas, Jimenez and Quemado soils are a source of caliche and gravel for use in road construction. The soils are not suited to use as cropland because of shallowness and low rainfall.

The soils are poorly suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, low soil strength affecting local roads and streets, slow permeability, and corrosivity to uncoated steel are the main limitations of Maverick soils. Shallowness to the strongly cemented pan and high gravel content are the main limitations of Jimenez and Quemado soils.

The soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

10. Lagloria-Rio Grande

Deep, nearly level, nonsaline, loamy soils

The landscape consists of broad stream terraces and narrow flood plains parallel to the Rio Grande. Lagloria soils are on broad, smooth stream terraces. Rio Grande soils are on narrow flood plains that are occasionally flooded (fig. 6).

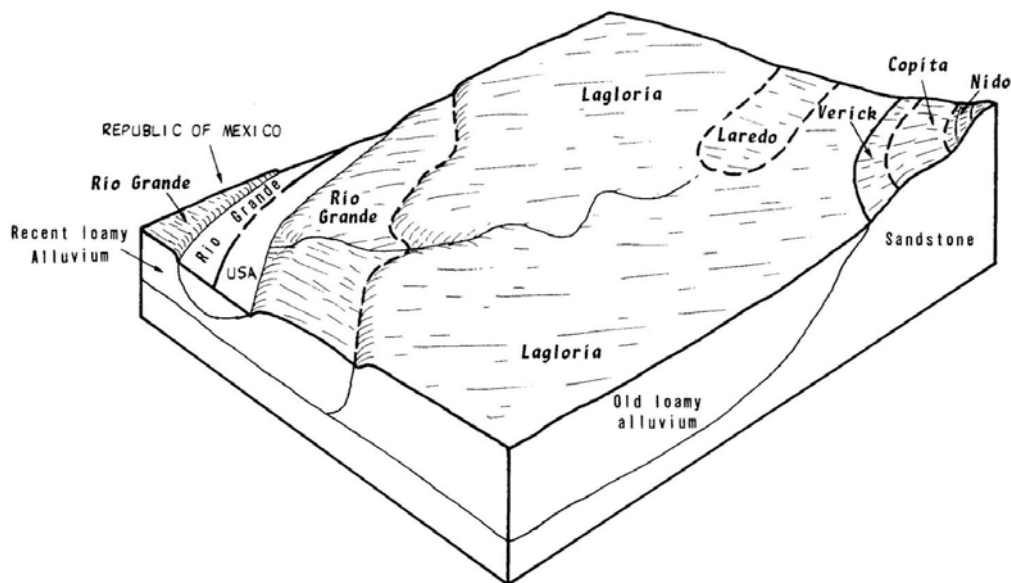


Figure 6.—Typical pattern of soils in the Lagloria-Rio Grande map unit.

This map unit makes up about 1.7 percent of the county. The composition is about 73 percent Lagloria soils and 16 percent Rio Grande soils. The remaining 11 percent is Laredo soils.

Lagloria soils are deep, well drained, and moderately permeable. Typically, these soils have a pale brown, calcareous silt loam surface layer about 19 inches thick. The subsoil, from 19 to 42 inches, is pale brown, calcareous loam. The underlying layer, from 42 to 63 inches, is light yellowish brown, calcareous loam.

Rio Grande soils are deep, well drained, and moderately rapidly permeable. Typically, these soils have a pale brown, calcareous very fine sandy loam surface

layer about 6 inches thick. The underlying layer, from 6 to 63 inches, is calcareous silt loam that is light brownish gray in the upper part and pale brown in the lower part.

The soils in this map unit are used mainly as rangeland and habitat for wildlife. These soils are well suited to use as irrigated cropland, and in a few areas they are used as irrigated cropland. The main crops are vegetables and grain sorghum. In a few areas the soils are used for irrigated pasture.

The Lagloria soils are well suited to most urban uses. Occasional flooding is a hazard on Rio Grande soils.

The soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove, which are plentiful in most years.

11. Nueces-Delfina

Deep, gently undulating, nonsaline, sandy soils

The landscape consists of broad plains separated by narrow valleys. Nueces soils are on broad, smooth, convex, gently undulating plains. Delfina soils are on broad, smooth plains and in shallow valleys.

This map unit makes up about 1.6 percent of the county. The composition is about 50 percent Nueces soils and 30 percent Delfina soils. The remaining 20 percent is Cuevitas, Delmita, Hebbronville, Randado, and Tela soils.

Nueces soils are deep, moderately well drained, and moderately slowly permeable. Typically, these soils have a brown fine sand surface layer about 26 inches thick. The upper part of the subsoil, from 26 to 51 inches, is brown sandy clay loam that has yellowish, reddish, and grayish mottles. The lower part of the subsoil, from 50 to 63 inches, is light yellowish brown sandy clay loam that has reddish mottles.

Delfina soils are deep, moderately well drained, and moderately slowly permeable. Typically, these soils have a brown loamy fine sand surface layer about 17 inches thick. The upper part of the subsoil, from 17 to 33 inches, is brown sandy clay loam that has reddish, brownish, and grayish mottles. The lower part of the subsoil, from 33 to 65 inches, is light yellowish brown sandy clay loam that has brownish and reddish mottles.

The soils making up this map unit are used mainly as rangeland and habitat for wildlife. They are poorly suited to use as cropland because of the low rainfall in the area.

The soils are moderately well suited to most urban uses. The sandy surface texture, moderately slow permeability, shrinking and swelling as a result of changes in moisture content, and low soil strength, which affects local roads and streets, are the main limitations.

These soils are moderately well suited to use as wildlife habitat. The most common wildlife species are deer, javelina, scaled quail, bobwhite quail, and mourning dove.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils".

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Lagloria silt loam, 0 to 1 percent slopes, is one of several phases in the Lagloria series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Delmita-Randado complex, gently undulating, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AgB—Aguilares sandy clay loam, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on broad, convex plains. Areas are irregular in shape and range from 20 acres to several thousand acres in size.

Typically, the surface layer is grayish brown sandy clay loam about 8 inches thick. The upper part of the subsoil, from 8 to 13 inches, is light brownish gray clay loam. The lower part of the subsoil, from 13 to 36 inches, is pale brown clay loam. The underlying layer, which extends to a depth of 72 inches or more, is very pale brown, saline, sandy clay loam that has common weakly cemented sandstone fragments in the lower part. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is low. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard, if the soil is left bare of vegetation.

The Aguilares soil and similar soils make up 90 to 95 percent of the map unit, and contrasting soils make up 5 to 10 percent. One soil that is similar to the Aguilares soil has a darker surface layer. Another similar soil is 15 to 35 percent, by volume, siliceous gravel. Contrasting soils include Brundage, Copita, Moglia, Montell, and

Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mainly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Deer, javelina, and quail are common in areas of this soil.

Under normal conditions, the native vegetation provides adequate cover and a wide variety of plant foods. Doves are also present in most seasons.

This soil is poorly suited to use as dryland cropland. The low available water capacity and the erratic rainfall distribution are the main limitations.

This soil is moderately well suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, and corrosivity to uncoated steel are the main limitations.

This soil is well suited to most recreation uses.

This soil is in the Gray Loamy Upland range site.

Ar—Arroyada clay, frequently flooded. This deep, nearly level, saline soil is on smooth, concave flood plains of streams. Areas are long and narrow and range from about 20 acres to more than 1,000 acres in size. Slopes range from 0 to 1 percent.

Typically, the surface layer is gray clay about 12 inches thick. The next layer, from 12 to 35 inches, is gray, saline clay. The underlying layer, which extends to a depth of 60 inches or more, is light brownish gray, saline clay that has brownish mottles. The soil is calcareous and moderately alkaline throughout.

This soil is somewhat poorly drained. Surface runoff is very slow, and permeability is very slow. The available water capacity is low. When this soil is dry, water enters it rapidly through cracks; when the soil is wet and the cracks are sealed, water enters very slowly. Flooding occurs for very brief to brief periods after heavy rainfall more often than once every 2 years, on the average. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

The Arroyada soil and similar soils make up 90 to 100 percent of the map unit, and contrasting soils make up the rest. One of the similar soils has a darker surface layer than that of the Arroyada soil. The contrasting soils include Brundage, Moglia, and Montell soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high, but palatability is low during most of the year. Gulf cordgrass is the dominant plant, and it is seldom used by wildlife except as a fawning ground for deer (fig. 7). No brush cover grows on this soil. Areas of this soil support less wildlife than most other areas in the county because of insufficient food and cover.

This soil is not suited to use as cropland. The hazard of flooding, low available water capacity, and salinity are the main limitations.

The main limitations for most urban uses are the flood hazard, very slow permeability, shrinking and swelling of the soil as a result of changes in moisture content, corrosivity to uncoated steel, and low soil strength, which affects local roads and streets.

This soil is poorly suited to most recreation uses. The flood hazard, clayey surface texture, and very slow permeability are the main limitations.

This soil is in the Lowland range site.



Figure 7.—A dense cover of gulf cordgrass on Arroyada clay, frequently flooded. The solitary bush is retama.

Bd—Brundage fine sandy loam, occasionally flooded. This deep, nearly level, saline soil is in valleys along small drainageways and on smooth plains parallel to drainageways. Areas are long and narrow and range from 20 acres to more than 1,000 acres in size. Slopes range from 0 to 1 percent.

Typically, the surface layer is brown, slightly acid fine sandy loam about 5 inches thick. The upper part of the subsoil, from 5 to 15 inches, is brown, saline, mildly alkaline sandy clay loam. The middle part, from 15 to 30 inches, is yellowish brown, saline, calcareous, moderately alkaline sandy clay loam. The lower part of the subsoil, from 30 to 46 inches, is light yellowish brown, saline, calcareous, moderately alkaline sandy clay loam. The underlying layer to a depth of 60 inches is brownish yellow, saline, calcareous, moderately alkaline sandy clay loam.

This soil is moderately well drained. Surface runoff is slow, and permeability is very slow. The available water capacity is low. Flooding occurs for brief periods after heavy rainfall less often than once every 2 years on the average. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

The Brundage soil and similar soils make up 65 to 80 percent of the map unit, and contrasting soils make up 20 to 35 percent. One of the similar soils is less saline than the Brundage soil. In small areas along some narrow drainageways, the Brundage soil is frequently flooded. In small areas on some smooth plains parallel to drainageways the Brundage soil is not subject to flooding. The contrasting soils are Aguilares, Catarina, Copita, Hebbronville, Moglia, Montell, Palafox, and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mainly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Only a few of the current plant species provide forage for deer, and cover is sparse in most places. Deer, javelina, and quail are more common in adjacent

areas of other soils where better cover is available. The dove population is small in areas of this soil because of an absence of food.

This soil is not suited to use as cropland. The hazard of flooding, the low available water capacity, salinity, high content of exchangeable sodium, and the hazards of water erosion and soil blowing are the main limitations.

The main limitations for most urban uses are the flood hazard, very slow permeability, salinity, high content of exchangeable sodium, and corrosivity to uncoated steel.

This soil is poorly suited to most recreation uses. The flood hazard, high content of exchangeable sodium, and salinity are the main limitations.

This soil is in the Claypan Prairie range site.

BrB—Brystal fine sandy loam, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on side slopes of low hills and smooth plains parallel to valleys. Areas are elongated or irregular in shape and range from 20 acres to more than 2,000 acres in size.

Typically, the surface layer is brown, neutral fine sandy loam about 12 inches thick. The subsoil to a depth of 23 inches is yellowish red, mildly alkaline sandy clay loam, and to a depth of 63 inches it is calcareous, moderately alkaline sandy clay loam that is yellowish red in the upper part and reddish yellow in the lower part.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

The Brystal soil and similar soils make up 85 to 95 percent of the map unit, and contrasting soils make up 5 to 15 percent. The similar soils include the Duval soil, which has less lime in the subsoil and has sandstone at 40 to 60 inches. Another similar soil has a thinner subsoil than that of the Brystal soil. The contrasting soils are Brundage, Copita, Dilley, and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Deer, javelina, and quail inhabit areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a good variety of plant food species. Doves are present in most seasons.

This soil is poorly suited to use as dryland cropland. Erratic rainfall distribution and the hazards of water erosion and soil blowing are the main limitations.

This soil is well suited to most urban and recreation uses. Corrosivity to uncoated steel is the main limitation for urban uses.

This soil is in the Sandy Loam range site.

CaB—Catarina clay, 0 to 2 percent slopes. This deep, nearly level to gently sloping, saline soil is in broad and narrow valleys along drainageways and on smooth plains (fig. 8). Areas are elongated or irregular in shape and range from 20 acres to several thousand acres in size.



Figure 8.—A typical area of Catarina clay, 0 to 2 percent slopes. This soil is used mainly as rangeland.

Typically, the surface layer is light brownish gray clay about 14 inches thick. The upper part of the subsoil, from 14 to 49 inches, is pale brown, saline clay. The lower part of the subsoil is very pale brown, saline clay to a depth of 96 inches. The soil is calcareous and mildly alkaline throughout.

This soil is moderately well drained. Surface runoff is medium, and permeability is very slow. The available water capacity is low. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

The Catarina soil and similar soils make up 95 to 100 percent of the map unit, and contrasting soils make up the rest. One of the similar soils has a gray surface layer; another has a dark surface layer. Small areas, along some narrow drainageways, of Catarina clay, occasionally flooded, are included. The contrasting soils are Brundage, Maverick, Moglia, Palafox, and Viboras soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Only a few of the current plant species provide forage for deer, and cover is sparse in most places. Deer, javelina, and quail are more common in areas adjacent to other soils where better cover and food are available. Fewer dove are found in areas of this soil because of insufficient food.

This soil is not suited to use as cropland. Low available water capacity, salinity, and high content of exchangeable sodium are the main limitations.

This soil is poorly suited to most urban uses. Very slow permeability, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, clayey surface texture, and corrosivity to uncoated steel are the main limitations.

This soil is poorly suited to most recreation uses. Very slow permeability, salinity, high content of exchangeable sodium, and the clayey surface texture are the main limitations.

This soil is in the Saline Clay range site.

CfA—Catarina clay, occasionally flooded. This deep, nearly level, saline soil is in narrow valleys along drainageways. Areas are long and narrow and range from 50 to 175 acres in size.

Typically, the surface layer is grayish brown clay about 9 inches thick. The upper part of the subsoil, from 9 to 18 inches, is grayish brown, saline clay. The middle layer, from 18 to 45 inches, is light olive brown, saline clay. The lower part of the subsoil to a depth of 60 inches is olive yellow, saline clay. This soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. Surface runoff is medium, and permeability is very slow. The available water capacity is low. When this soil is dry, water enters it rapidly through cracks, but when the soil is wet and the cracks are sealed, water enters very slowly. Flooding occurs for very brief to brief periods after heavy rainfall less often than once every 2 years on the average. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard if this soil is left bare of vegetation.

The Catarina soil and similar soils make up 90 to 100 percent of the map unit, and contrasting soils make up the rest. One soil that is similar to the Catarina soil has a gray surface layer. Another similar soil has a dark surface layer. Small areas of Catarina soil, along some narrow drainageways, are frequently flooded. Contrasting soils are Brundage, Maverick, Moglia, Palafox, and Viboras soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mainly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Only a few of the current plant species provide forage for deer, and cover is sparse in most places. Deer, javelina, and quail are more common in areas adjacent to this Catarina soil where better cover and food are available.

Fewer dove are found in areas of this soil because of insufficient food.

This soil is not suited to use as cropland. The hazard of flooding, low available water capacity, salinity, and high content of exchangeable sodium are the main limitations.

The main limitations of this soil for most urban uses are the hazard of flooding, the very slow permeability, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, clayey surface texture, and corrosivity to uncoated steel.

This soil is poorly suited to most recreation uses. The hazard of flooding, clayey surface texture, high content of exchangeable sodium, salinity, and very slow permeability are the main limitations.

This soil is in the Saline Clay range site.

CoB—Comitas fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on smooth, convex plains. Areas are irregular in shape and range from 20 to 300 acres in size.

Typically, the surface layer is dark grayish brown, neutral fine sand about 12 inches thick. The next layer, which extends to a depth of 26 inches, is brown, neutral fine sand. The next layer extends to a depth of 35 inches and is brown, neutral loamy fine sand. The upper part of the subsoil, from 35 to 50 inches, is brown, neutral fine sandy loam. The lower part of the subsoil to a depth of 63 inches is light brown, mildly alkaline sandy clay loam that has reddish yellow mottles.

This soil is well drained. Surface runoff is very slow, and permeability is moderately rapid. The available water capacity is medium. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard if this soil is left bare of vegetation.

The Comitas soil and similar soils make up 90 to 95 percent of the map unit, and contrasting soils make up 5 to 10 percent. One of the similar soils has a sandy surface layer less than 20 inches thick. The contrasting soils are Brundage and

Nueces soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Deer, javelina, quail, and doves are common in areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a variety of food plants. In some areas, insufficient water limits bird numbers.

This soil is poorly suited to use as dryland cropland. The hazard of soil blowing and the erratic distribution of rainfall are the main limitations. This soil is not used as irrigated cropland because of the lack of irrigation water.

This soil is well suited to most urban uses.

This soil is poorly suited to most recreation uses. The sandy texture of the surface layer is the main limitation.

This soil is in the Loamy Sand range site.

CpB—Copita fine sandy loam, 0 to 3 percent slopes. This moderately deep, nearly level to gently sloping soil is on summits and side slopes of low hills and on broad, convex plains. Areas are irregular in shape and range from 20 acres to several thousand acres in size.

Typically, the surface layer is brown fine sandy loam about 9 inches thick. The upper part of the subsoil, from 9 to 24 inches, is yellowish brown sandy clay loam. The lower part of the subsoil, from 24 to 37 inches, is light yellowish brown sandy clay loam. The underlying layer to a depth of 60 inches is pale yellow sandstone that is weakly cemented in the upper part and strongly cemented in the lower part. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is low. The rooting zone is moderately deep. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

The Copita soil and similar soils make up 85 to 95 percent of the map unit, and contrasting soils make up 5 to 15 percent. One of the similar soils has sandstone at a depth of 40 to 50 inches. Also included are areas where the Copita soil has a surface texture of sandy clay loam. The contrasting soils are Brundage, Hebbbronville, Moglia, Nido, Palafox, Tela, and Verick soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Deer, javelina, and quail are common in areas of this soil. Doves are also present in most seasons. Under normal conditions, the native vegetation provides adequate cover and a variety of food plants.

This soil is not suited to use as dryland cropland. The low available water capacity, the hazards of water erosion and soil blowing, the moderately deep root zone, and erratic distribution of rainfall are the main limitations. A few areas near the Rio Grande are used for irrigated vegetables and irrigated pasture. If this soil is used as irrigated cropland, management should stress erosion control, moisture conservation, maintenance of good tilth, and minimum tillage.

This soil is moderately well suited to most urban uses. The depth to sandstone and the corrosivity to uncoated steel are the main limitations.

This soil is well suited to most recreation uses.

This soil is in the Gray Sandy Loam range site.

CRB—Cuevitas-Randado complex, gently undulating. These very shallow and shallow soils are on broad, slightly convex plains and on the summits and side slopes of low hills. The areas are irregular in shape and range from 20 acres to several thousand acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer of the Cuevitas soil is neutral fine sandy loam about 9 inches thick. It is brown in the upper 2 inches and reddish brown in the lower part.

Below that, strongly cemented caliche extends to a depth of 16 inches. The next layer to a depth of 60 inches is weakly cemented caliche.

The Cuevitas soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is very shallow. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

Typically, the surface layer of the Randado soil is neutral fine sandy loam about 10 inches thick. It is reddish brown in the upper 3 inches and red in the lower part. The subsoil, from 10 to 16 inches, is red, neutral sandy clay loam. Below that, strongly cemented caliche extends to a depth of 22 inches. The next layer to a depth of 60 inches is weakly cemented caliche.

The Randado soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is shallow. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

This complex is 45 to 65 percent Cuevitas soil and similar soils, 30 to 40 percent Randado soil and similar soils, and 0 to 25 percent contrasting soils and scattered areas of rock outcrop. A soil that is similar to the Cuevitas soil has a thinner surface layer than that of the Cuevitas soil. The Zapata soil is similar to both the Cuevitas and the Randado soil but has more carbonates. The contrasting soils are Delmita and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

These soils are used mostly as rangeland and as habitat for wildlife. They are also important sources of caliche for construction material.

Forage yields for cattle are low. Normally, brush grows more heavily on these soils than on nearby soils. The brush provides cover for a wide variety of wildlife, but because they are shallow the soils do not provide an abundance of food plants, other than browse, suitable for wildlife. The carrying capacity of the soils for deer, javelina, and quail is generally not so high as that of the more productive surrounding soils.

The soils making up this complex are not suited to use as dryland cropland. The very shallow to shallow rooting zone, the very low available water capacity, the erratic distribution of rainfall, and the hazards of water erosion and soil blowing are the main limitations.

These soils are poorly suited to most urban and recreation uses. The main limitation is shallowness to a cemented pan.

The soils are in the Shallow Sandy Loam range site.

DeB—Delfina loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on broad, smooth plains and in shallow valleys. The areas are elongated or irregular in shape and range from 20 acres to 1,000 acres in size.

Typically, the surface layer is brown, neutral loamy fine sand about 17 inches thick. The upper part of the subsoil, from 17 to 33 inches, is brown, neutral sandy clay loam and has reddish, brownish, and grayish mottles. The next layer, from 33 to 40 inches, is light yellowish brown, neutral sandy clay loam that has brownish mottles. The next layer, from 40 to 54 inches, is light yellowish brown, mildly alkaline sandy clay loam that has brownish mottles in the upper part. The underlying layer is a depth of 65 inches is light yellowish brown, mildly alkaline sandy clay loam that has reddish mottles.

This soil is moderately well drained. Surface runoff is slow, and permeability is moderately slow. The available water capacity is medium. This soil is saturated with water above the subsoil for short periods after heavy rainfall. The rooting zone is deep, but the subsoil is not easily penetrated by plant roots. Water erosion is a moderate hazard and soil blowing a severe hazard if this soil is left bare of vegetation.

The Delfina soil and similar soils make up 90 to 100 percent of the map unit, and contrasting soils make up the rest. One of the similar soils has a surface layer less than 10 inches thick, another has a surface layer 20 to 25 inches thick. Another similar soil has more lime in the subsoil than the Delfina soil. Contrasting soils include Delmita, Hebbronville, Nueces, and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Deer, javelina, quail, and dove are common in areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a variety of food plants. In some areas, a lack of water limits bird populations.

This soil is poorly suited to use as dryland cropland. The erratic distribution of rainfall and the hazards of water erosion and soil blowing are the main limitations.

This soil is moderately well suited to most urban uses. Shrinking and swelling as a result of changes in moisture content, the moderately slow permeability, and the low soil strength, which affects local roads and streets, are the main limitations.

This soil is well suited to most recreation uses.

This soil is in the Loamy Sand range site.

DmB—Delmita loamy fine sand, 0 to 3 percent slopes. This moderately deep soil is on broad, convex plains. Areas are irregular in shape and range from 20 to 500 acres in size.

Typically, the surface layer is reddish brown, neutral loamy fine sand about 14 inches thick. The upper part of the subsoil, from 14 to 22 inches, is red, neutral fine sandy loam. The lower part of the subsoil, from 22 to 36 inches, is red, neutral sandy clay loam. Below that, strongly cemented caliche extends to a depth of 39 inches. The next layer is weakly cemented caliche to a depth of 60 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is low. The rooting zone is moderately deep. Water erosion is a moderate hazard, and soil blowing is a severe hazard if this soil is left bare of vegetation.

The Delmita soil and similar soils make up 80 to 90 percent of the map unit, and contrasting soils make up 10 to 20 percent. One similar soil has hard caliche at 40 to 50 inches, and another similar soil has a sandy surface layer 20 to 25 inches thick. Another similar soil has less clay in the subsoil than the Delmita soil. The contrasting soils are Comitas, Hebbronville, Nueces, Randado, and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Deer, javelina, quail, and doves are common in areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a good variety of food plants.

This soil is poorly suited to use as dryland cropland. The hazards of water erosion and soil blowing, the moderate rooting depth, the low available water capacity, and the erratic rainfall distribution are the main limitations. This soil is not used as irrigated cropland because of the lack of irrigation water.

This soil is moderately well suited to most urban uses. The cemented pan is the main limitation.

This soil is well suited to most recreation uses.

This soil is in the Red Sandy Loam range site.

DRB—Delmita-Randado complex, gently undulating. These moderately deep and shallow soils are on broad, convex plains. Areas are irregular in shape and range from 20 acres to several thousand acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer of the Delmita soil is reddish brown, neutral loamy fine sand about 12 inches thick. The upper part of the subsoil, from 12 to 22 inches, is red, neutral fine sandy loam. The lower part of the subsoil, from 22 to 34 inches, is

red, neutral sandy clay loam. Below that, strongly cemented caliche extends to a depth of 36 inches. The next layer to a depth of 60 inches is weakly cemented caliche.

The Delmita soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is low. The rooting zone is moderately deep. Water erosion is a moderate hazard, and soil blowing is a severe hazard if this soil is left bare of vegetation.

Typically, the surface layer of the Randado soil is reddish brown, neutral loamy fine sand about 9 inches thick. The subsoil, from 9 to 18 inches, is reddish brown, neutral fine sandy loam. Below that, strongly cemented caliche extends to a depth of 23 inches. The next layer to a depth of 60 inches is weakly cemented caliche.

The Randado soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is shallow. Water erosion is a moderate hazard and soil blowing a severe hazard if this soil is bare of vegetation.

This complex is 60 to 70 percent Delmita soil and similar soils, 25 to 40 percent Randado soil and similar soils, and 0 to 15 percent contrasting soils. Among the similar soils are a soil that has hard caliche at a depth of 40 to 50 inches and the Cuevitas soil, which has hard caliche at a depth of 7 to 10 inches. The contrasting soils are the Hebbronville, Tela, and Zapata soils. The percentages were determined by the use of sampling transects across areas of the map unit.

These soils are used mostly as rangeland and as habitat for wildlife. They are also an important source of caliche for road construction. Forage yields for cattle are medium. Deer, javelina, quail, and doves are common in areas of these soils. Under normal conditions, the native vegetation provides adequate cover and a good variety of food plants.

The soils making up this complex are poorly suited to use as dryland cropland. The low to very low available water capacity, the hazards of water erosion and soil blowing, the moderately deep to shallow rooting depth, and the erratic distribution of rainfall are the main limitations. These soils are not used as irrigated cropland because of the lack of irrigation water.

These soils are moderately well suited to most urban uses. The cemented pan is the main limitation.

These soils are well suited to most recreation uses.

The Delmita soil is in the Red Sandy Loam range site. The Randado soil is in the Shallow Sandy Loam range site.

DsB—Dilley fine sandy loam, 0 to 3 percent slopes. This shallow soil is on convex plains and on the summits and side slopes of low hills. Areas are irregular in shape and range from 20 acres to 1,000 acres in size.

Typically, the surface layer is reddish brown, neutral fine sandy loam about 8 inches thick. The upper part of the subsoil, from 8 to 13 inches, is yellowish red, neutral fine sandy loam. The lower part of the subsoil, from 13 to 16 inches, is reddish yellow, calcareous, moderately alkaline fine sandy loam. The underlying layer to a depth of 60 inches is strong brown, noncalcareous, weakly cemented sandstone that has fine sandy loam in cracks and crevices in the upper part.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is shallow. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

The Dilley soil and similar soils make up 85 to 95 percent of the map unit, and contrasting soils make up 5 to 15 percent. Similar soils include the Verick soil, which is calcareous and brownish, and the Nido soil, which is calcareous, brownish, and less than 10 inches deep over sandstone. Another similar soil has sandstone at a depth between 20 and 30 inches. The contrasting soils are Brystal, Copita, and Duval

soils. Also included in the mapped areas are small, scattered areas of rock outcrop. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are low. Brush growth on this soil is normally heavy, providing cover for a variety of wildlife, but the soil is too shallow to produce an abundance of wildlife food plants other than browse. The carrying capacity of this soil for deer, javelina, and quail is generally not so high as that of the more productive surrounding soils.

This Dilley soil is not suited to use as dryland cropland. The very low available water capacity, the shallow rooting zone, the hazards of water erosion and soil blowing, and the erratic distribution of rainfall are the main limitations to this use.

This soil is poorly suited to most urban and recreation uses. The shallowness to sandstone is the main limitation.

This soil is in the Shallow Sandy Loam range site.

DvB—Duval fine sandy loam, 0 to 3 percent slopes. This deep soil is on broad, convex plains and on the summits and side slopes of low hills. Areas are irregular in shape and range from 20 acres to more than 1,000 acres in size.

Typically, the surface layer is reddish brown, neutral fine sandy loam about 14 inches thick. The upper part of the subsoil, from 14 to 22 inches, is reddish brown, neutral fine sandy loam. The middle part of the subsoil, from 22 to 46 inches, is red, neutral sandy clay loam. The lower part of the subsoil, from 46 to 56 inches, is yellowish red, neutral sandy clay loam. The underlying layer to a depth of 62 inches is yellowish red, noncalcareous sandstone.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. The rooting zone is deep, and the soil is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate if this soil is bare of vegetation.

The Duval soil and similar soils make up 85 to 95 percent of the map unit, and contrasting soils make up 5 to 15 percent. Similar soils include the Brystal soil, which has more lime in the subsoil than the Duval soil. One similar soil has sandstone at a depth of 30 to 40 inches, and another soil has sandstone at a depth of more than 60 inches. The contrasting soils are Dilley and Tela soils. The percentages were determined by use of transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Deer, javelina, quail, and doves inhabit areas of this soil. Under normal circumstances, the native vegetation provides adequate cover and a variety of food plants. Insufficient amounts of water in some areas limit bird numbers.

This Duval soil is poorly suited to use as dryland cropland. The erratic distribution of rainfall and the hazards of water erosion and soil blowing are the main limitations.

This soil is well suited to most urban and recreation uses.

This soil is in the Sandy Loam range site.

HeB—Hebbronville loamy fine sand, 0 to 2 percent slopes. This deep, nearly level to gently sloping soil is on broad, convex plains. Areas are irregular in shape and range from 20 acres to several thousand acres in size.

Typically, the upper part of the surface layer is grayish brown, neutral loamy fine sand about 4 inches thick. The lower part of the surface layer, which extends to a depth of 19 inches, is grayish brown, mildly alkaline fine sandy loam. The subsoil is fine sandy loam. It is yellowish brown from 19 to 34 inches and light yellowish brown from 34 to 46 inches. It is calcareous and moderately alkaline throughout. The underlying layer to a depth of 60 inches is very pale brown, calcareous, moderately alkaline sandy clay loam.

This soil is well drained. Surface runoff is slow, and permeability is moderately rapid. The available water capacity is medium. The rooting zone is deep, and the soil

is easily penetrated by plant roots. Water erosion is a slight hazard and soil blowing a severe hazard if this soil is left bare of vegetation.

The Hebbronville soil and similar soils make up 80 to 90 percent of the map unit, and contrasting soils make up 10 to 20 percent. One soil that is similar to the Hebbronville soil has more clay in the subsoil. Another similar soil has more lime in the surface layer. Contrasting soils are Aguilares, Brundage, Copita, and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Deer, javelina, quail, and doves inhabit areas of this soil because the native vegetation commonly provides adequate cover and a good variety of plant food species. The lack of water in some areas limits bird numbers.

A small acreage of this Hebbronville soil is used for pasture (figs. 9, 10).



Figure 9.—A vigorous stand of buffelgrass on Hebbronville loamy fine sand, 0 to 2 percent slopes, following brush removal and seeding.

This soil is poorly suited to use as dryland cropland. The hazard of soil blowing and the erratic distribution of rainfall are the main limitations to this use.

This soil is well suited to most urban and recreation uses.

This soil is in the Sandy Loam range site.



Figure 10.—Crossbred cattle grazing an area of Hebbronville loamy fine sand, 0 to 2 percent slopes. Previously cleared native brush is invading the area.

JQD—Jimenez-Quemado complex, undulating. These shallow to very shallow soils are on the summit and side slopes of hills and ridges. Areas are irregular to elongated in shape and range from 20 acres to several thousand acres in size. Slopes range from 1 to 8 percent.

The Jimenez soil is mainly on side slopes of hills and ridges, and the Quemado soil is mainly on the summit of hills and ridges. The areas of these soils are so intricately mixed that mapping them separately was not practical at the scale used in mapping.

Typically, the surface layer of the Jimenez soil is very gravelly sandy clay loam about 13 inches thick. The upper 9 inches is dark brown, and the lower 4 inches is brown. Below that, strongly cemented caliche extends to a depth of 25 inches. The next layer is very gravelly, weakly cemented caliche to a depth of 60 inches. The soil is calcareous and moderately alkaline throughout.

The Jimenez soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is shallow to very shallow. The water erosion hazard is moderate, and the soil blowing hazard is slight if this soil is bare of vegetation.

Typically, the surface layer of the Quemado soil is neutral, reddish brown, very gravelly sandy loam about 6 inches thick. The subsoil, which extends to a depth of 12 inches, is neutral, reddish brown, very gravelly sandy clay loam. The underlying layer, which extends to a depth of 14 inches, is strongly cemented caliche. The next layer is very gravelly, weakly cemented caliche to a depth of 60 inches.

The Quemado soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight if this soil is bare of vegetation.

This soil complex is 40 to 55 percent Jimenez soil and similar soils, 30 to 50 percent Quemado soil and similar soils, and 0 to 30 percent contrasting soils and scattered areas of rock outcrop. One soil that is similar to the Jimenez soil has a lighter colored surface layer. A soil that is similar to the Quemado soil has hard caliche at 20 to 30 inches. The contrasting soils are Aguilares, Catarina, Copita,

Maverick, Nido, and Palafox soils. The percentages were determined by use of sampling transects across areas of the map unit.

The soils are used mostly as rangeland and as habitat for wildlife. They are also an important source of caliche and gravel for use as construction materials.

Forage yields for cattle are low. Under normal conditions, heavier brush grows on these soils than on nearby soils (fig. 11). Although the brush provides cover for a wide variety of wildlife species, these shallow, gravelly soils do not produce an abundance of food plants palatable to wildlife. Only browse is readily available. As a result, the carrying capacity of these soils for deer, javelina, and quail is lower than that of the more productive surrounding soils.

These soils are not suited to use as cropland. The high gravel content, very low available water capacity, and very shallow to shallow rooting zone are the main limitations.

These soils are poorly suited to most urban and recreation uses. The very shallow to shallow depth to a cemented pan and the high content of gravel are the main limitations.

Jimenez and Quemado soils are in the Gravelly Ridge range site.

LgA—Lagloria silt loam, 0 to 1 percent slopes. This deep, nearly level soil is on smooth terraces parallel to the Rio Grande. The areas are elongated and range from 20 acres to more than 1,000 acres in size.

Typically, the surface layer is pale brown silt loam about 19 inches thick. The subsoil, which extends to a depth of 42 inches, is pale brown loam. The underlying layer to a depth of 63 inches is light yellowish brown loam. The soil is calcareous and moderately alkaline throughout.



Figure 11.—A thick canopy of brush in an area of Jimenez-Quemado complex, undulating. Blackbrush, cenizo, and guajillo are the dominant brush species.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is medium. The rooting zone is deep, and the soil is easily

penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard if this soil is left bare of vegetation.

The Lagloria soil and similar soils make up more than 90 percent of the map unit, and contrasting soils make up the rest. One similar soil, Rio Grande, is stratified at a shallow depth and is occasionally flooded. The contrasting soils are Copita, Laredo, and Palafox soils. Also included are small areas of the Lagloria soil where the slopes are 1 to 3 percent.

This soil is used mostly as rangeland and as habitat for wildlife. A few small areas are used as irrigated cropland and irrigated pasture. The main irrigated crops are grain sorghum and vegetables (fig. 12). The main irrigated pasture grasses are buffelgrass, Coastal bermudagrass, and kleingrass.

Forage yields for cattle are high. Areas of this soil support a wide variety of plants, including some trees, which provide food and cover for deer, javelina, quail, doves, and many other birds and animals. The nearby Rio Grande provides a ready water supply for wildlife. White-wing doves are present in most seasons.

This soil is suited to use as dryland cropland, but no acreage is in dryland cultivation. The erratic distribution of rainfall and the hazard of soil blowing are the main limitations. This soil is well suited to use as irrigated cropland. Irrigation water is pumped from the Rio Grande. Management of this soil as cropland should stress moisture conservation, maintenance of good tilth, and minimum tillage. Land leveling improves irrigation water management if a gravity flow system of irrigation is used.

This Lagloria soil is well suited to most urban and recreation uses.

This soil is in the Loamy Bottomland range site.

LgB—Lagloria silt loam, 1 to 3 percent slopes. This deep, gently sloping soil is on smooth terraces parallel to the Rio Grande. The areas are elongated and range from 20 to 600 acres in size.



Figure 12.—An irrigated field of sorghum on Lagloria silt loam, 0 to 1 percent slopes.

Typically, the surface layer is grayish brown silt loam about 13 inches thick. The subsoil, which extends to a depth of 37 inches, is light brownish gray, very fine sandy loam. The underlying layer to a depth of 60 inches is pale brown, very fine sandy loam. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

The Lagloria soil and similar soils make up more than 85 percent of the map unit, and contrasting soils make up the rest. One similar soil is the Rio Grande soil, which is stratified at a shallow depth and is occasionally flooded. The contrasting soils are Copita, Laredo, and Palafox soils. Also included are small areas of the Lagloria soil where slopes range from 0 to 1 percent or from 3 to 5 percent.

This soil is used mostly as rangeland and as habitat for wildlife. A few small areas are used as irrigated pasture and irrigated cropland. The main irrigated pasture grasses are buffelgrass, Coastal bermudagrass, and kleingrass. The main irrigated crop is grain sorghum.

Forage yields for cattle are high. Areas of this soil support a wide variety of plants, including some trees, which provide a good source of food and cover for deer, javelina, quail, doves, and many other birds and animals. The nearby Rio Grande provides a ready water supply for wildlife. White-wing doves are present in most seasons.

This soil is suited to use as dryland cropland, but no acreage is in dryland cultivation. The erratic rainfall distribution and the hazards of water erosion and soil blowing are the main limitations. This soil is suited to use as irrigated pasture and irrigated cropland. Irrigation water is pumped from the Rio Grande. Management of this soil as cropland should stress erosion control, moisture conservation, the maintenance of good tilth, and minimum tillage. Bench leveling improves irrigation water management and reduces water erosion if a gravity flow system of irrigation is used.

This soil is well suited to most urban and recreation uses.

This soil is in the Loamy Bottomland range site.

LrA—Laredo silty clay loam, rarely flooded. This deep, nearly level soil is on concave terraces. During cyclonic storms, these terraces become drainageways that flow into the Rio Grande. The areas are elongated and range from 20 to 250 acres in size. Slopes range from 0 to 1 percent.

Typically, the surface layer is dark grayish brown silty clay loam about 18 inches thick. The upper part of the subsoil, from 18 to 38 inches, is brown silty clay loam. The lower part of the subsoil, which extends to a depth of 50 inches, is pale brown silty clay loam. The underlying layer to a depth of 60 inches is very pale brown silty clay loam. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. Flooding is not a hazard under normal conditions, but flooding is possible on this soil after abnormally heavy rainfall. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

The Laredo soil and similar soils make up more than 85 percent of the map unit, and contrasting soils make up the rest. One soil that is similar to the Laredo soil has a lighter colored surface layer. Another similar soil has a dark surface layer more than 20 inches thick, and another has more clay in the subsoil than the Laredo soil. The contrasting soils are Copita, Lagloria, and Tela soils.

This soil is used mostly as rangeland and as habitat for wildlife. A few small areas are used as irrigated cropland. The main crop is grain sorghum.

Forage yields for cattle are high. Areas of this soil support a wide variety of plants, including some trees, which are a good source of food and cover for deer, javelina, quail, doves, and many other birds and animals. The nearby Rio Grande provides a ready water supply for wildlife. White-wing doves are present in most seasons.

This soil is suited to use as dryland cropland, but no acreage is in dryland cultivation. Rare flooding and the erratic distribution of rainfall are the main limitations. This soil is well suited to use as irrigated cropland. Irrigation water is pumped from the Rio Grande. Management of this soil as cropland should stress moisture conservation, the maintenance of good tilth, and minimum tillage. Land leveling improves irrigation water management if a gravity flow method of irrigation is used.

The main limitations to most urban uses are the hazard of flooding, the shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, and corrosivity to uncoated steel.

This soil is well suited to most recreation uses.

This soil is in the Loamy Bottomland range site.

MCE—Maverick-Catarina complex, gently rolling. These moderately deep and deep soils are on hills and in narrow valleys. The Maverick soil is on the summit and side slopes of hills (fig. 13). Slopes range from 3 to 10 percent. The Catarina soil is in narrow valleys and on foot slopes of hills. Slopes are less than 2 percent. The areas of this complex range from 20 acres to several thousand acres in size.



Figure 13.—Maverick clay on a side slope in an area of Maverick-Catarina complex, gently rolling.
The soil is used mainly as rangeland and habitat for wildlife.

The areas of the Maverick soil and of the Catarina soil are so intricately mixed that mapping them separately was not practical at the scale used in mapping.

Typically, the surface layer of the Maverick soil is grayish brown clay about 6 inches thick. The subsoil, from 6 to 15 inches, is light olive brown saline clay. From 15 to 25 inches, it is pale olive saline clay. The underlying material to a depth of 60 inches is pale yellow, saline, fractured shaly clay. The soil is calcareous and moderately alkaline throughout.

The Maverick soil is well drained. Surface runoff is rapid, and permeability is slow. The available water capacity is low. The rooting zone is moderately deep. Water erosion is a severe hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

Typically, the surface layer of the Catarina soil is grayish brown clay about 10 inches thick. The upper part of the subsoil, from 10 to 25 inches, is light brownish gray, saline clay. The middle part of the subsoil, from 25 to 37 inches, is light yellowish brown, saline clay. The lower part of the subsoil is pale yellow, saline clay to a depth of 60 inches. The soil is calcareous and moderately alkaline throughout.

The Catarina soil is moderately well drained. Surface runoff is medium, and permeability is very slow. The available water capacity is low. When this soil is dry, water enters it rapidly through cracks, but when the soil is wet and the cracks are sealed, water enters very slowly. Flooding occurs, for very brief to brief periods after heavy rainfall, less often than once every 2 years on the average. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

This soil complex is 55 to 70 percent Maverick soil and similar soils, 20 to 40 percent Catarina soil and similar soils, and 0 to 25 percent contrasting soils. The similar soils include the Viboras soil, which is like the Maverick soil but has reddish colors. Another soil that is similar to the Maverick soil has shaly clay at a depth of 15 to 20 inches. A soil that is similar to the Catarina soil has a gray surface layer. The Catarina soil in small areas on some narrow plains at the foot slopes of hills is not subject to flooding. The Maverick soil in small areas on the summit of hills is 15 to 50 percent gravel, by volume. The contrasting soils are Jimenez, Moglia, Palafox, and Quemado soils. The percentages were determined by use of sampling transects across areas of the map unit.

These soils are used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Under normal conditions, the native vegetation provides adequate food and cover for wildlife, including deer, javelina, and quail. The carrying capacity of these soils, however, is lower than that of the more productive surrounding soils.

The soils making up this complex are not suited to use as cropland. The main limitations for the Maverick soil are salinity, very low available water capacity, slope, the moderately deep rooting zone, and the hazard of water erosion. The main limitations for the Catarina soil are flooding, salinity, the low available water capacity, the hazard of water erosion, and the high content of exchangeable sodium.

The Maverick soil is poorly suited to most urban uses. Slow permeability, clayey texture, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, and corrosivity to uncoated steel are the main limitations.

The Catarina soil also is poorly suited to most urban uses. The main limitations are the hazard of flooding, very slow permeability, shrinking and swelling as a result of changes in moisture content, low strength, which affects local roads and streets, the clayey surface texture, and corrosivity to uncoated steel.

These soils are suited to most recreation uses. The slow to very slow permeability, salinity, clayey surface texture, and slope are the main limitations.

The Maverick soil is in the Rolling Hardland range site. The Catarina soil is in the Saline Clay range site.

MgC—Moglia clay loam, 1 to 5 percent slopes. This deep, gently sloping soil is on convex plains and on summits and side slopes of low hills. The areas are irregular in shape and range from 20 acres to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, moderately alkaline clay loam about 7 inches thick. The upper part of the subsoil, from 7 to 21 inches, is pale brown, saline, mildly alkaline clay. The lower part of the subsoil, which extends to a depth of 30 inches, is very pale brown, saline, mildly alkaline clay loam. The underlying layer to a depth of 60 inches is pink, saline, mildly alkaline loam that grades to clay loam in the lower part. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderately slow. The available water capacity is low. The rooting zone is deep. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

The Moglia soil and similar soils make up 75 to 80 percent of the map unit, and contrasting soils make up 20 to 25 percent. One soil is similar to the Moglia soil but has more clay in the subsoil. The contrasting soils in this map unit are Aguilares, Brundage, Catarina, Copita, Maverick, and Montell soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Deer, javelina, and quail are common in areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a wide variety of food plants. Doves are also present in most seasons.

This soil is not suited to use as dryland cropland. Salinity, the hazard of water erosion, the low available water capacity, erratic rainfall distribution, and the high content of exchangeable sodium are the main limitations.

This soil is moderately well suited to most urban uses. Moderately slow permeability, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, and corrosivity to uncoated steel are the main limitations.

This soil is well suited to most recreation uses.

This soil is in the Clay Loam range site.

MnB—Montell clay, saline, 0 to 2 percent slopes. This deep, nearly level to gently sloping saline soil is in broad and narrow valleys along drainageways and on smooth plains. The areas range from narrow and elongated to irregular in shape and range from 20 acres to several thousand acres in size.

Typically, the surface layer is gray clay about 12 inches thick. The next layer, which extends to a depth of 28 inches, is gray, saline clay. Below that, the soil is pale brown saline clay to a depth of 60 inches. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. Surface runoff is slow, and permeability is very slow. The available water capacity is low. When this soil is dry, water enters it rapidly through cracks, but when the soil is wet and the cracks are sealed, water enters very slowly. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

The Montell soil and similar soils make up 95 to 100 percent of the map unit, and contrasting soils make up the rest. One of the similar soils is the Catarina soil, which is brownish or yellowish and has cracks that remain open for longer periods than those in the Montell soil. Montell clay, occasionally flooded, is in small areas along some narrow drainageways, and Montell soils that are nonsaline to a depth of 20 inches or more are in small areas on some smooth plains. The contrasting soils in this map unit are

Aguilares, Arroyada, Brundage, Moglia, and Viboras soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Plant species that provide forage for deer are not abundant, and cover is sparse in some places. Deer, javelina, and quail commonly use areas of other soils adjacent to this soil where better cover and food plants are available.

This Montell soil is not suited to use as cropland. Salinity, erratic rainfall distribution, and the high content of exchangeable sodium are the main limitations.

This soil is poorly suited to most urban uses. Very slow permeability, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, the clayey surface texture, and corrosivity to uncoated steel are the main limitations.

This soil is poorly suited to most recreational uses.

The very slow permeability, the clayey surface texture, and salinity are the main limitations.

This soil is in the Clay Flat range site.

Mo—Montell clay, occasionally flooded. This deep, nearly level, saline soil is in narrow valleys along drainageways. Areas are long and narrow and range from 25 to 250 acres in size.

Typically, the surface layer is dark gray clay about 10 inches thick. The next layer, from 10 to 23 inches, is gray, saline clay. The next layer, from 23 to 40 inches, is brown, saline clay. The underlying layer to a depth of 65 inches is pale brown, saline clay. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. Surface runoff is slow, and permeability is very slow. The available water capacity is low. When this soil is dry, water enters it rapidly through cracks, but when the soil is wet and the cracks are sealed, water enters very slowly. This soil is flooded less often than once every 2 years for very brief to brief periods after heavy rainfall. The rooting zone is deep, but the soil is not easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing a slight hazard if this soil is left bare of vegetation.

The Montell soil and similar soils make up 90 to 100 percent of the map unit, and contrasting soils make up the rest. One of the similar soils is the Catarina soil, which is brownish or yellowish, and has cracks that remain open for longer periods. In some narrow valleys there are soils that are nonsaline to a depth of 20 inches or more. The contrasting soils in this map unit are the Aguilares, Arroyada, Brundage, Moglia, and Viboras soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Only a few of the plants that normally provide forage for deer grow on this soil, and cover is sparse in some places. Deer, javelina, and quail commonly use areas of other soils adjacent to this soil where better cover and food plants are available.

This soil is not suited to use as cropland. The hazards of flooding and water erosion, the erratic distribution of rainfall, the salinity, and the high content of exchangeable sodium are the main limitations.

The main limitations for most urban uses are the hazard of flooding, the very slow permeability, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, the clayey surface texture, and corrosivity to uncoated steel.

This soil is poorly suited to most recreational uses. The hazard of flooding, the very slow permeability, the clayey surface texture, and salinity are the main limitations.

The soil is in the Clay Flat range site.

NDF—Nido-Rock outcrop complex, hilly. This complex consists of very shallow, gently sloping to sloping Nido soil and areas of Rock outcrop. The Nido soil is on the summit and side slopes of hills and ridges. The areas are elongated or irregular in shape and range from 20 to 800 acres in size. Slopes range from 3 to 20 percent.

The Nido soil and the areas of Rock outcrop are so intricately mixed that mapping them separately was not practical at the scale used in mapping.

Typically, the surface layer of the Nido soil is yellowish brown, calcareous, moderately alkaline fine sandy loam about 7 inches thick. The underlying layer to a depth of 60 inches is brownish yellow, weakly cemented sandstone. Fine sandy loam is in cracks and crevices in the upper part of the sandstone.

This soil is well drained. Surface runoff is rapid, and permeability is moderate. The available water capacity is very low. The rooting zone is very shallow. The hazard of water erosion is severe, and the hazard of soil blowing is moderate if this soil is bare of vegetation.

Rock outcrop consists of areas where the sandstone bedrock is exposed.

This complex is 75 to 80 percent Nido soil and similar soils, 15 to 25 percent Rock outcrop, and 0 to 10 percent contrasting soils. The similar soils include the Verick soil, which has sandstone at 10 to 20 inches. The contrasting soils are Copita, Jimenez, and Quemado soils. The percentages were determined by use of sampling transects across areas of the map unit.

This Nido soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are low. Under normal conditions, heavy brush growth on this soil provides cover for a variety of wildlife, but the shallow soil does not produce an abundance of food plants other than browse. The carrying capacity of this soil for deer, javelina, and quail is not as high as that of the more productive surrounding soils.

The Nido soil is not suited to use as cropland. The rock outcrops, the slope, the very shallow rooting depth, the very low available water capacity, and the hazards of water erosion and soil blowing are the main limitations.

This soil is poorly suited to most urban and recreation uses. The depth to sandstone, the slope, and the rock outcrops are the main limitations.

The Nido soil is in the Shallow Ridge range site.

NOC—Nido Variant-Rock outcrop complex, gently undulating. This complex consists of very shallow, gently sloping Nido Variant soil and areas of Rock outcrop. The Nido Variant soil is on summits and side slopes of low hills. Areas are elongated and range from 20 to 250 acres in size. Slopes range from 1 to 5 percent.

Typically, the surface layer of the Nido Variant soil is light brownish gray, mildly alkaline loam about 7 inches thick. The underlying layer is white, noncalcareous, strongly cemented, tuffaceous sandstone to a depth of 60 inches or more.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is very shallow. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

This soil complex is 70 to 85 percent Nido Variant soil and similar soils and 10 to 20 percent Rock outcrop. The rest is contrasting soils. One soil that is similar to the Nido Variant soil is 15 to 35 percent, by volume, gravel. The contrasting soils in this map unit are soils that are more than 35 percent, by volume, gravel. The percentages were determined by use of sampling transects across areas of the map unit.

The Nido Variant soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are low. Under normal conditions, brush growth is heavy on this soil. The brush provides cover for a variety of wildlife, but the shallow soil does not produce an abundance of wildlife plant food other than browse. The carrying capacity of this soil for deer, javelina, and quail is not as high as that of the more productive surrounding soils.

The Nido Variant soil is not suited to use as cropland. The very shallow rooting depth, the very low available water capacity, the hazard of water erosion, and the rock outcrops are the main limitations to this use.

This soil is poorly suited to most urban and recreation uses. The very shallow depth to tuffaceous sandstone is the main limitation.

This soil complex is in the Shallow Ridge range site.

NuB—Nueces fine sand, 0 to 3 percent slopes. This deep, nearly level soil is on broad, smooth, convex plains. The areas are irregular to elongated in shape and range from 20 acres to several thousand acres in size.

Typically, the surface layer is brown, neutral fine sand about 26 inches thick. The upper part of the subsoil, from 26 to 40 inches, is brown, neutral sandy clay loam that has yellowish, reddish, and grayish mottles. The middle part, from 40 to 51 inches, is brown, mildly alkaline sandy clay loam that has reddish and yellowish mottles. The lower part of the subsoil to a depth of 63 inches is light yellowish brown, mildly alkaline sandy clay loam that has reddish mottles.

This soil is moderately well drained. Surface runoff is very slow, and permeability is moderately slow. The available water capacity is medium. This soil is saturated by water above the subsoil for short periods after heavy rainfall. The rooting zone is deep, but the subsoil is not easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard if this soil is left bare of vegetation.

The Nueces soil and similar soils make up 85 to 90 percent of the map unit, and contrasting soils make up 10 to 15 percent. One soil that is similar to the Nueces soil has a sandy surface layer 40 to 51 inches thick. Another similar soil has more clay in the subsoil than the Nueces soil. The contrasting soils in this map unit are Comititas, Delfina, Delmita, and Hebbronville soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. An abundance of forbs growing on this soil supports some deer, but deer numbers are limited by the sparse brush cover.

Quail are plentiful in most years. The absence of a source of water in some areas limits bird numbers.

This Nueces soil is poorly suited to use as dryland cropland. The hazard of soil blowing and the erratic distribution of rainfall are the main limitations.

This soil is moderately well suited to most urban uses. Moderately slow permeability and the sandy surface texture are the main limitations.

This soil is poorly suited to most recreation uses. The sandy surface texture is the main limitation.

This soil is in the Sandy range site.

PaB—Palafox clay loam, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on broad, slightly convex plains, foot slopes of hills, and smooth plains parallel to valleys. The areas are irregular in shape and range from 20 acres to 1,000 acres in size.

Typically, the surface layer is brown clay loam about 12 inches thick. The upper part of the subsoil, from 12 to 28 inches, is brown clay loam. The middle part, from 28 to 34 inches, is yellowish brown clay loam. The lower part of the subsoil, from 34 to 45 inches, is light yellowish brown, saline clay loam. The underlying layer to a depth of 72 inches is light yellowish brown, saline clay loam. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderately slow. The available water capacity is medium. The rooting zone is deep. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

The Palafox soil and similar soils make up 80 to 90 percent of the map unit, and contrasting soils make up 10 to 20 percent. One soil that is similar to the Palafox soil

has a darker surface layer. Another similar soil has less lime in the subsoil than the Palafox soil. Contrasting soils included in this map unit are Catarina, Copita, Jimenez, Maverick, and Tela soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mostly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Deer, javelina, and quail are common in areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a wide variety of food plants. Doves are also present in most seasons.

This soil is not suited to use as dryland cropland. The erratic distribution of rainfall and the hazard of water erosion are the main limitations.

This soil is moderately well suited to most urban uses. The moderately slow permeability, shrinking and swelling as a result of changes in moisture content, low soil strength, which affects local roads and streets, and corrosivity to uncoated steel are the main limitations.

This soil is well suited to most recreation uses.

This soil is in the Clay Loam range site.

Pt—Pits. This unit consists of areas where caliche or gravel, or both, has been excavated for use as road construction material (fig. 14). In most areas, caliche or gravel has been removed to a depth of 3 to 20 feet. The areas are irregular in shape and range from 5 to 100 acres in size.



Figure 14.—Gravel and caliche are mined in this area for use in road construction. This pit was formerly an area of Jimenez-Quemado complex, undulating.

The surface material in the pits is mainly caliche or gravel. In these areas, the original soils were either pushed to the perimeter of the pit or were carried away with the caliche and gravel.

Surface runoff, permeability, and available water capacity of these materials are variable, depending on the type of material.

Most caliche and gravel pits are associated with Cuevitas, Delmita, Jimenez, Nido Variant, Quemado, Randado, and Zapata soils.

Commonly, these areas support little or no vegetation. Unless they are reclaimed, they are not suited to use as rangeland or cropland or as habitat for wildlife or to most urban and recreation uses.

In most of these areas, reclamation measures include grading and shaping, spreading topsoil, and establishing a permanent vegetative cover.

This unit was not assigned to a range site.

Rg—Rio Grande very fine sandy loam, occasionally flooded. This deep, nearly level soil is on the flood plain of the Rio Grande. The areas are long and narrow and range from 20 to 750 acres in size. Slopes range from 0 to 1 percent.

Typically, the surface layer is pale brown very fine sandy loam about 6 inches thick. The underlying layer is silt loam to a depth of 63 inches or more. The upper part, from 6 to 25 inches, is light brownish gray, and the lower part, from 25 to 63 inches, is pale brown. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderately rapid. The available water capacity is high. This soil is flooded, for brief periods, less often than once every 2 years on the average. Flooding occurs after the release of water at Amistad Reservoir, as well as after heavy rainfall along the tributaries of the Rio Grande below the Amistad Reservoir. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion is a slight hazard and soil blowing a moderate hazard if this soil is left bare of vegetation.

The Rio Grande soil and similar soils make up more than 85 percent of the map unit, and contrasting soils make up the rest. The similar soils include the Lagloria soil, which is stratified at a lower depth and is not subject to flooding. Also included are small areas where the Rio Grande soil is frequently flooded. These areas are on some narrow flood plains adjacent to the Rio Grande and along some narrow tributaries that empty into the river. The contrasting soils include Laredo soils and a soil that has more sand than the Rio Grande soil.

In small areas of the Rio Grande soil, the slopes range from 1 to 3 percent.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Areas of this soil support a wide variety of plants, including some trees. The plants are a good source of food and cover for deer, javelina, quail, and doves, as well as for many other birds and animals. The nearby Rio Grande provides a ready water supply for wildlife. White-wing doves are present in most seasons.

This soil is poorly suited to use as dryland cropland. The erratic distribution of rainfall and the hazards of flooding and soil blowing are the main limitations.

The main limitations for most urban uses are the flooding hazard and corrosivity to uncoated steel.

This Rio Grande soil is moderately well suited to most recreation uses. The hazard of flooding is the main limitation.

This soil is in the Loamy Bottomland range site.

Te—Tela sandy clay loam, frequently flooded. This deep, nearly level soil is in shallow, narrow valleys along small drainageways. Areas are long and narrow and range from 20 acres to more than 1,000 acres in size. Slopes range from 0 to 1 percent.

Typically, the surface layer is dark grayish brown, mildly alkaline sandy clay loam about 14 inches thick. The upper part of the subsoil, from 14 to 19 inches, is grayish brown, mildly alkaline sandy clay loam. The middle part of the subsoil, from 19 to 40 inches, is grayish brown, calcareous, moderately alkaline sandy clay loam. The lower part of the subsoil, from 40 to 45 inches, is light brownish gray, calcareous, moderately alkaline sandy clay loam. The underlying layer to a depth of 63 inches is light brownish gray, calcareous, moderately alkaline loam.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. This soil is flooded, for very brief to brief periods

after heavy rainfall, more often than once every 2 years. The rooting zone is deep, and the soil is easily penetrated by plant roots. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

The Tela soil and similar soils make up 75 to 90 percent of the map unit, and contrasting soils make up 10 to 25 percent. One soil that is similar to the Tela soil has a dark surface layer more than 20 inches thick. In small areas along small drainageways, the Tela soil is only occasionally flooded. The contrasting soils in this map unit are Aguilares, Catarina, Copita, Brystal, Delfina, Delmita, Duval, Hebbbronville, Moglia, Montell, and Palafox soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are high. Because this soil is along drainageways, it receives abundant water. The resulting plant growth on these long, narrow areas provides excellent cover, browse, and food for a variety of wildlife species. This Tela soil is prime wildlife habitat, being several times more valuable than surrounding soils. It provides ideal habitat for feral hogs.

This soil is not suited to use as cropland. The hazards of water erosion and flooding are the main limitations.

The main limitation for most urban uses is the hazard of flooding.

This soil is poorly suited to most recreation uses. The hazard of flooding is the main limitation.

This soil is in the Ramadero range site.

To—Torriorthents, loamy-skeletal. These deep, gently sloping to strongly sloping soils are on the summits and side slopes of hills or ridges and on broad smooth plains. The areas are elongated in shape and are about 400 acres in size. Slopes range from 1 to 10 percent.

Torriorthents, loamy-skeletal, consist of mine spoil or overburden from coal mining that was reclaimed by placing a layer of topsoil on the surface (fig. 15). The topsoil is mainly the upper layer of Copita, Jimenez, Maverick, Nido, Palafox, Quemado, and Verick soils that was excavated and stockpiled during mining. The mine spoil or overburden consists of unconsolidated loamy material, fragments of consolidated rocks, and fragments of coal. These materials were excavated from a trench 40 to 50 feet deep in strip mining the coal.

Typically, Torriorthents, loamy-skeletal, are calcareous, moderately alkaline, yellowish, brownish, or grayish fine sandy loam, sandy clay loam, or gravelly sandy loam to a depth of about 8 to 20 inches. The next layer to a depth of 60 inches is calcareous or noncalcareous, moderately alkaline extremely stony sandy loam, extremely stony loam, or very stony sandy loam. It is 35 to 70 percent, by volume, sandstone, shale, siltstone, and coal fragments.

The characteristics and ratings assigned to Torriorthents, loamy-skeletal, apply only to the mapped areas. Areas reclaimed in the future may have other characteristics.

These soils are well drained. Surface runoff is medium to rapid, depending on slope. Permeability is moderate to slow. The available water capacity is low to medium. The rooting zone is deep. Water erosion is a moderate to severe hazard and soil blowing a slight to moderate hazard if these soils are left bare of vegetation.

These soils are used as habitat for wildlife, but in the future they may be used as rangeland. Wildlife cover is sparse in most places, but deer, javelina, and quail use areas of other soils along the edges of these soils where better cover is available. Doves are present in most seasons.



Figure 15.—A vigorous stand of buffelgrass on reclaimed mine spoil in an area of Torriorthents, loamy-skeletal.

Native grasses, native shrubs, native forbs, and buffelgrass grow on these soils.

These soils are not suited to use as cropland. Slope, the hazard of water erosion, and the erratic distribution of rainfall are the main limitations.

These soils were not assigned to a range site.

VkC—Verick fine sandy loam, 1 to 5 percent slopes. This shallow, gently sloping soil is on the summits and side slopes of low hills. The areas are rounded or irregular in shape and range from 20 acres to more than 1,000 acres in size.

Typically, the surface layer is yellowish brown, calcareous, moderately alkaline fine sandy loam about 9 inches thick. The subsoil, from 9 to 15 inches, is light yellowish brown, calcareous, moderately alkaline fine sandy loam. The underlying layer is light yellowish brown weakly cemented sandstone to a depth of 60 inches or more.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is shallow. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation.

The Verick soil and similar soils make up 90 to 100 percent of the map unit, and contrasting soils and scattered areas of rock outcrop make up the rest. Among the soils similar to the Verick soil are the Dilley soil, which has reddish colors, and the Nido soil, which has sandstone at a depth between 3 and 10 inches. Another soil that is similar to the Verick soil has sandstone at a depth between 20 and 30 inches. The contrasting soils are Jimenez, Maverick, and Quemado soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used as rangeland and as habitat for wildlife. Forage yields for cattle are low. Under normal conditions, brush growth on this soil is heavy, providing cover for a variety of wildlife species. However, this shallow soil does not produce an abundance of food, other than browse, for wildlife. The carrying capacity of this soil for deer, javelina, and quail is not as high as that of the more productive surrounding soils.

This Verick soil is not suited to use as dryland cropland. The very low available water capacity, the erratic distribution of rainfall, the shallow rooting depth, and the hazards of water erosion and soil blowing are the main limitations.

This soil is poorly suited to most urban and recreation uses. Shallowness to sandstone is the main limitation. This soil is in the Shallow Sandy Loam range site.

VrB—Viboras clay, 0 to 3 percent slopes. This moderately deep, nearly level to gently sloping soil is on broad, smooth plains and in broad, smooth valleys. The areas are irregular in shape and range from 20 acres to several thousand acres in size.

Typically, the upper part of the surface layer is brown clay about 3 inches thick. The next layer, which extends to a depth of 9 inches, is reddish brown, calcareous clay.

The subsoil, from 9 to 28 inches, is reddish brown, saline, calcareous clay. The underlying layer to a depth of 60 inches is reddish brown, saline, calcareous, fractured siltstone and shaly clay. The soil is moderately alkaline throughout.

This soil is moderately well drained. Surface runoff is medium, and permeability is very slow. The available water capacity is very low. The rooting zone is moderately deep. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

The Viboras soil and similar soils make up 80 to 95 percent of the map unit, and contrasting soils make up 5 to 20 percent. The similar soils include the Maverick soil, which has yellowish colors, and a soil that has siltstone or shaly clay at a depth between 40 and 45 inches. The contrasting soils included in this map unit are Brundage, Catarina, Moglia, and Montell soils. The percentages were determined by use of sampling transects across areas of the map unit.

This soil is used mainly as rangeland and as habitat for wildlife. Forage yields for cattle are medium. Only a few of the plant species that provide forage for deer grow on this soil, and cover is sparse in many places. Deer, javelina, and quail are more common in adjacent areas of other soils where better cover and food are available. The dove population is small in areas of this soil because of the absence of food plants.

This soil is not suited to use as cropland. Salinity, the moderately deep rooting zone, the hazard of water erosion, and the high content of exchangeable sodium are the main limitations.

This Viboras soil is poorly suited to most urban uses. The very slow permeability of the soil, the clayey texture, shrinking and swelling as a result of changes in moisture content, the low soil strength, which affects local roads and streets, and the corrosivity to uncoated steel are the main limitations.

This soil is poorly suited to most recreation uses. The high content of exchangeable sodium, salinity, and the clayey surface texture are the main limitations.

This soil is in the Saline Clay range site.

ZAC—Zapata-Rock outcrop complex, gently undulating. This complex consists of very shallow, gently sloping Zapata soil and areas of Rock outcrop. The Zapata soil is on summits and side slopes of low hills. The areas are rounded or irregular in shape and range from 20 to 250 acres in size. Slopes range from 1 to 5 percent.

Typically, the surface layer of the Zapata soil is brown, calcareous, moderately alkaline gravelly sandy loam about 7 inches thick. The underlying layer, which extends to a depth of 10 inches, is fractured, indurated caliche. Below that, to a depth of 60 inches, there is pale brown, strongly cemented caliche that becomes less cemented with depth.

The Zapata soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The rooting zone is very shallow. Water erosion is a moderate hazard and soil blowing a slight hazard if this soil is left bare of vegetation.

The Rock outcrop in this map unit consists of exposed, indurated or strongly cemented caliche.

This soil complex is 75 to 85 percent Zapata soil and similar soils, 10 to 20 percent Rock outcrop, and 0 to 15 percent contrasting soils. The similar soils include the Cuevitas soil, which has reddish colors and no lime in the surface layer, and a soil that has a darker surface layer than that of the Zapata soil. Another soil is similar to the Zapata soil but has hard caliche at a depth between 10 and 20 inches. Another similar soil is more than 35 percent, by volume, gravel. The contrasting soils are Copita, Nido, Randado, Tela, and Verick soils. The percentages were determined by use of sampling transects across areas of the map unit.

The Zapata soil is used mostly as rangeland and as habitat for wildlife. It is an important source of caliche and gravel for use as construction material. Forage yields for cattle are low. Brush grows more heavily on this soil than on nearby soils. The brush provides cover for a wide variety of wildlife, but because the soil is shallow and gravelly it does not produce an abundance of wildlife food plants other than browse. The carrying capacity of this soil for deer, javelina, and quail is not so high as that of the more productive surrounding soils.

This soil is not suited to use as cropland. The very shallow rooting zone, the very low available water capacity, the hazard of water erosion, and the rock outcrops are the main limitations.

The Zapata soil is poorly suited to most urban uses. The shallowness to a cemented pan, the rock outcrop, and corrosivity to uncoated steel are the main limitations.

This soil is poorly suited to most recreation uses. The shallowness to a cemented pan and the gravelly surface texture are the main limitations.

The Zapata soil is in the Shallow Ridge range site.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short-and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated

with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use in the Laredo area has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

There are no areas of prime farmland in Webb County in their native state. Also, nonirrigated cropland and pastureland are not considered to be prime farmland.

The following map units, or soils, where irrigated, make up prime farmland in Webb County. "Where irrigated" means that a dependable supply of irrigation water of adequate quality has been developed. Areas of these soils that are urban or built-up land are excluded. Urban or built-up land is defined as any contiguous unit of land 10 acres or more in size that is used for nonfarm uses including housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units". This list does not constitute a recommendation for a particular land use. If a soil is considered to be prime farmland only under certain conditions, other than irrigation, the conditions are specified in footnotes following the list.

AgB	Aguilares sandy clay loam, 0 to 3 percent slopes
BrB	Brystal fine sandy loam, 0 to 3 percent slopes
CoB	Comitas fine sand, 0 to 3 percent slopes ¹
CpB	Copita fine sandy loam, 0 to 3 percent slopes
DeB	Delfina loamy fine sand, 0 to 3 percent slopes ¹
DmB	Delmita loamy fine sand, 0 to 3 percent slopes ¹
DvB	Duval fine sandy loam, 0 to 3 percent slopes
HeB	Hebbronville loamy fine sand, 0 to 2 percent slopes ¹
LgA	Lagloria silt loam, 0 to 1 percent slopes
LgB	Lagloria silt loam, 1 to 3 percent slopes ²
LrA	Laredo silty clay loam, rarely flooded
MgC	Moglia clay loam, 1 to 5 percent slopes ²
PaB	Palafox clay loam, 0 to 3 percent slopes
Rg	Rio Grande very fine sandy loam, occasionally flooded ³

¹ Where wind erosion is not a major concern.

² Where water erosion is not a major concern.

³ Where flooding during the growing season occurs less often than once in 2 years.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and to the environment. Also, it can help prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils.

They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Rangeland

By Stephen Nelle, range conservationist, Soil Conservation Service.

About 95 percent of Webb County, approximately 2 million acres, is rangeland used primarily for cattle grazing and as habitat for wildlife.

The average size of a ranch in Webb County, if those ranches that are less than 250 acres are excluded, is about 5,500 acres. One ranch is more than 100,000 acres, and several are larger than 50,000 acres. Most ranches have commercial cow-calf herds, but a few ranches have stocker operations also.

Rangeland is land on which the native climax vegetation is made up of a wide variety of grasses, forbs, shrubs, and trees that are suitable for grazing or browsing. Climax vegetation refers to the potential plant community that a certain area or soil is capable of producing. The plant community, or mixture of plants, is the combination that is best suited to the soils and climate in a particular area. The climax vegetation is the most stable and normally the most productive and desirable combination of plants that an area can support.

Rangeland also includes land that has been artificially revegetated to provide forage that is managed in the same way as native rangeland. Rangeland receives no regular or frequent cultural treatment. The kind and amount of vegetation produced on rangeland depends on the soil, topography, climate, the fire hazard, and grazing management.

When European man first entered this area with domestic livestock, the climax vegetation consisted of semiopen grasslands. Scattered thin brush grew on the upland soils, and denser brush or thickets grew along the lowland creeks and draws. The gravelly and very shallow hills were dominated by grasses and scattered stands of low brush. Periodic widespread range fires and widely scattered grazing by native herbivores—buffalo, deer, and antelope—were responsible for keeping the area basically a grassland with relatively thin upland brush canopies.

The plant communities and the condition of the rangeland in Webb County have changed drastically in the past 300 years. Heavy and often continuous grazing by cattle and sheep over the years has caused the rangeland to deteriorate. Most of the taller, more nutritious and productive grasses and forbs have been grazed out. Excessive grazing for prolonged periods has permitted the increase of shallow-rooted, unproductive, and unpalatable kinds of grasses and forbs. Simultaneously,

the number and extent of range fires have been drastically reduced because sufficient fuel to carry fire is not present.

The combination of overgrazing and fewer range fires has allowed the brush to increase and, in most areas, to dominate the vegetation. Thick canopies of the climax brush species are common where only scattered, thin stands of brush used to grow. The predominance of shrubby, woody kinds of plants has earned this area the name "brush country". The amount of forage produced in some areas is now estimated to be less than 10 percent of that originally produced.

In most areas, good grazing management allows the more desirable climax plants to reestablish themselves, thus increasing the productivity of the rangeland. The two basic practices that make up good grazing management are proper stocking of the range and the use of grazing methods that allow rest periods for all pastures.

Proper stocking involves calculating the number of livestock that can graze an area, based on its forage production. On properly stocked range, no more than about half of the weight of the better grasses is grazed each year. Rotation grazing, in which cattle are grouped into herds and rotated among several pastures, allows one pasture or more to be removed from grazing pressure at all times. A combination of proper stocking and periodic rest periods gives the better forage plants the competitive edge needed to reproduce and spread, thus crowding out the poorer plants. These practices also protect the soils from excessive erosion and prevent compaction of the soils, thus enabling them to absorb maximum amounts of rainfall.

Because brush competes with range forage for sunlight, water, and nutrients, most ranchers routinely attempt to control brush and increase forage production. Brush can be controlled by chaining, dragging, shredding, roller chopping, disking, rootplowing, grubbing, stacking, or raking or by prescribed burning or using herbicides or by any combination of these practices.

Practices that cause some soil disturbance are generally accompanied by range seeding. Buffelgrass is by far the most commonly used grass for range seeding because of its ease of establishment and its high forage yield. Buffelgrass grows well on most of the loamy soils in the survey area. Other perennial grasses that are sometimes seeded are kleingrass, plains bristlegrass, and kleburg bluestem. Weak perennial grasses that may persist only several years, such as blue panicgrass and sorghum alnum, are sometimes added to provide large amounts of initial grazing until the desired species become established.

Range forage production occurs primarily in two distinct growing periods. Commonly, about 40 percent of the yearly growth occurs in April, May, and early in June, when about 6 inches of rain normally falls. Another 40 percent of the yearly growth usually occurs late in August, September, and October, when another 6 inches of rain normally falls. The remaining 20 percent of the yearly growth occurs during the rest of the year, depending on rainfall and temperature. During summer, the range plant communities usually go into a semidormant state induced by insufficient moisture. Growth is greatly reduced in winter and early in spring because of cool temperatures and low rainfall. Occasionally, during a mild winter with above normal rainfall, the vegetation may stay green. Likewise, in years when summer rainfall is above normal, forage production is high.

Periods of drought of variable duration and excessively wet periods are normal in the county. Because of erratic rainfall and its distribution, livestock producers must raise or lower cattle numbers in response to drought and wet periods, which directly affect the amount of forage available.

Range Sites and Condition Classes

On the basis of their ability to support native vegetation, the soils in Webb County are grouped into 17 different range sites. Soils that produce about the same kinds, amounts, and proportions of native plants make up a range site. Each range site

produces its own characteristic plant community that responds differently to overgrazing, chemical or mechanical brush control, drought, and fire. Ranchers need a thorough knowledge of soil types and range sites to plan and carry out good grazing management and range improvement practices.

Range sites that have desirable soil characteristics produce more forage of higher quality than do range sites that have less desirable characteristics under the same kind of management. Some desirable soil characteristics that increase the value of a range site are good rainfall infiltration, high available water holding capacity, good inherent fertility, deep rooting zone, absence of excessive lime, absence of excessive salinity, level to gently rolling topography, and good drainage and aeration. Regardless of desirable soil characteristics, however, a range site can never reach its optimum productivity unless it is properly managed.

The term “range condition” refers to a similarity of the present plant community to the climax or potential plant community for that particular range site. The more similar the present vegetation is to the climax, the higher the range condition.

The range condition of a particular range site depends on the level of grazing management. Cattle are selective grazers; they prefer to feed exclusively on the more palatable plants, called decreasers. If the more palatable grasses and forbs are continually overgrazed, their numbers become reduced and they eventually die out of the plant community. As the desirable decreaser plants die, they are replaced by less productive plants of lower quality, called increasers, which can withstand a greater degree of overgrazing. If continuous overgrazing persists, then even these increaser plants become grazed out of the plant community. They are replaced by unproductive plants of low quality that have minimal value to livestock. The continued decrease in range condition is known as “range deterioration”. If proper grazing management is practiced, the process can be reversed, and the more nutritious and productive plants can become reestablished and spread. This process is called “range improvement”.

Range that is kept in the better range condition classes or that is reseeded to suitable desirable grazing plants provides high forage yields and is protected from excessive soil erosion and water loss. The number of livestock that an area can support depends on the range site, range condition, effectiveness and amount of past brush control and range seeding, the grazing system used in the area, and the climate from season to season. Local representatives of the Soil Conservation Service can help landowners plan and carry out a management program to make optimum use of the rangeland resource.

Following is a description of each range site in Webb County. The climax plant community is described, as well as the site's response to heavy and continuous grazing. For additional data on the soils in each range site, refer to the section “Detailed Soil Map Units”. Estimated potential annual production for each soil is shown in table 5. A list of common and scientific names for range plants in the county is given in table 6.

Clay Flat Range Site

The Montell soils, map units MnB and Mo, make up this site. These soils are deep and saline, and they have a low available water capacity.

The climax plant community is mainly semiopen grassland; thin brush canopies make up 5 to 10 percent of the community. The amount of brush has been kept at this level by periodic widespread range fires. The brush is generally low-growing and somewhat stunted because the soils are saline and droughty.

About 25 percent of the climax plant community is pink pappusgrass and plains bristlegass. About 10 percent is twoflower trichloris and silver bluestem, 10 percent is alkali sacaton, 10 percent is Arizona cottontop and lovegrass tridens, 20 percent is curlmesquite and tobosa, and 10 percent is vine-mesquite, buffalograss, white tridens, and Wright's sacaton. About 5 percent of the climax plant community

consists of fall witchgrass, slim tridens, perennial threeawn, whorled dropseed and Texas bristlegrass. About 5 percent is forbs, including bundleflower, orange zexmania, bushsunflower, and saladilla and some annual forbs. About 5 percent is woody plants, including mesquite, granjeno, whitebrush, guayacan, fourwing saltbush, lotebush, amargosa, pricklypear, tasajillo, huisache, screwbean, and twisted acacia.

As the climax plant community deteriorates from heavy and continuous grazing, twoflower trichloris, Arizona cottontop, alkali sacaton, and the more palatable perennial forbs decrease and eventually are grazed out of the plant community. These plants are replaced initially by pink pappusgrass and plains bristlegrass and later by curlymesquite (fig. 16).

Eventually, with continued heavy use of the range, the understory vegetation consists mainly of a blanket of curlymesquite and significant amounts of red grama, including bitterweed, annual broomweed, and coneflower.

Continued overuse and no periodic range fires result in a moderate to thick canopy of mesquite and other climax brush species. Thick canopies of goldenweed commonly invade under these conditions.

At this stage of range deterioration, significantly large areas are bare, and the soil begins to crust. Because of the crusting, less water is absorbed by the soil and more water runs off the soil. Thus, there is an increased hazard of erosion. Evaporation at the surface increases, causing salts in the subsoil to rise nearer to the surface. Consequently, the site becomes more droughty.



Figure 16.—Curlymesquite grass, pricklypear, and mesquite brush on Montell clay, saline, 0 to 2 percent slopes; Clay Flat range site.

Clay Loam Range Site

The Moglia and Palafox soils, map units MgC and PaB, make up this site. These soils are deep and have low to medium available water capacity.

The climax plant community is semiopen grassland; scattered brush canopies make up 5 to 15 percent of the community. The brush canopy has been kept at that level by periodic widespread range fires.

About 45 percent of the climax vegetation is twoflower and fourflower trichloris, Arizona cottontop, and lovegrass tridens. About 10 percent is silver bluestem; 20

percent is pink pappusgrass, plains bristlegrass, and hooded windmillgrass; and 10 percent is curlymesquite, buffalograss, and tobosa. About 5 percent of the climax vegetation is perennial threeawn, fall witchgrass, Texas bristlegrass, and slim tridens. About 5 percent is forbs, including bundleflower, western ragweed, orange zexmenia, bushsunflower, dalea, and some annual forbs. About 5 percent of the yearly production is woody plants, including mesquite, blackbrush, guajillo, lotebush, pricklypear, whitebrush, granjeno, guayacan, ephedra, allthorn, amargosa, twisted acacia, creosotebush, shrubby blue sage, cenizo, desert yaupon, and chomonique.

Range deterioration occurs as a result of heavy and continuous grazing. As deterioration of the climax plant community progresses, twoflower and fourflower trichloris, Arizona cottontop, lovegrass tridens, and many palatable perennial forbs are the first plants to be grazed out. These plants are initially replaced by plains bristlegrass and pink pappusgrass and later by curlymesquite and tobosa.

Eventually, if heavy use continues, the understory plant composition changes mainly to Texas bristlegrass, perennial threeawn, red grama, Hall's panicum, unpalatable perennial forbs, and annual forbs, such as dogweed and annual broomweed. Continued overgrazing and no periodic range fires result in a dense canopy of guajillo, blackbrush, pricklypear, mesquite, and other climax brush species in addition to goldenweed and ericameria.

At this stage of range deterioration, the soil surface begins to crust, retarding the infiltration of rainfall and the germination of seeds. Because a large percentage of the site is bare, erosion is a severe hazard.

Claypan Prairie Range Site

The Brundage soil, map unit Bd, makes up this site. This soil is deep and saline, and it has a low available water capacity. This soil has a high content of sodium. Consequently, the subsoil has poor structure, which impedes the movement of air, moisture, and roots through the soil.

The climax plant community is a semiopen grassland supporting a scattered canopy of brush (fig. 17).



Figure 17.—An area of Brundage fine sandy loam, occasionally flooded, in the Claypan prairie range site.

The brush has been kept at a low level by the unfavorable soil characteristics and by periodic range fires.

About 10 percent of the climax plant community is twoflower trichloris, fourflower trichloris, lovegrass tridens, and Arizona cottontop. About 40 percent is pink pappusgrass, plains bristlegrass, sand dropseed, hooded windmillgrass, and pinhole bluestem; 10 percent is vine-mesquite and white tridens; 15 percent is buffalograss and curlymesquite; and 5 percent is whorled dropseed. Other grasses, which make up about 10 percent of the climax vegetation, are fall witchgrass, slim tridens, and Texas bristlegrass. Bundleflower, bushsunflower, orange zexmenia, ruellia, and other forbs make up about 5 percent.

Woody plants make up about 5 percent of the climax plant community. The plants include mesquite, whitebrush, huisache, pricklypear, tasajillo, amargoso, lotebush, granjeno, cilindrillo, and screwbean.

As the range condition deteriorates from heavy and continuous grazing, twoflower trichloris, fourflower trichloris, Arizona cottontop, lovegrass tridens, and the most palatable forbs decrease and eventually are grazed out of the plant community. These plants are replaced by pink pappusgrass, plains bristlegrass, curlymesquite, hooded windmillgrass, and less palatable forbs and brush.

With continued heavy use of the range and further deterioration, the understory vegetation is dominated by whorled dropseed, red grama, red lovegrass, threeawn, and unpalatable forbs. In many places, goldenweed dominates the plant community at this stage of range deterioration.

Continued heavy use and no periodic range fires result in a moderate canopy of brush.

At this stage of deterioration, much of the site is bare. The topsoil washes away, leaving the subsoil exposed. As a result, the rainfall intake rate is very slow, and seed germination is greatly impeded.

Gravelly Ridge Range Site

The Jimenez and Quemado soils, map unit JQD, make up this site. These soils are very shallow to shallow. They absorb rainfall readily and have a very low available water capacity.

The climax plant community is a shrubland or chaparral that has an understory of mid and short grasses.

About 30 percent of the climax vegetation is Arizona cottontop, tanglehead, and pinhole bluestem. About 15 percent is bush muhly, slender grama, and green sprangletop; 5 percent is lovegrass tridens; 5 percent is hooded windmillgrass and fall witchgrass; 5 percent is Texas bristlegrass; and 5 percent is perennial threeawn and slim tridens. About 10 percent is forbs, including orange zexmenia, shorthorn zexmenia, bushsunflower, and mariola and some annual forbs. Near the Rio Grande, candelilla contributes heavily to forb production. About 25 percent of the climax plant community is woody plants, such as guajillo, blackbrush, kidneywood, coma, cenizo, guayacan, mesquite, lotebush, knifeleaf, condalia, chomonque, southwestern bernardia, creosotebush, amargosa, paloverde, and skeletonleaf goldeneye.

The brush canopy has remained fairly dense because of insufficient grass production to fuel range fires that would have kept the canopy more open.

Retrogression of the plant community occurs as the site is heavily and continuously grazed. Arizona cottontop, tanglehead, lovegrass tridens, bush muhly, and green sprangletop and the most palatable perennial forbs are grazed out of the plant community. The plants that have decreased are initially replaced by hooded windmillgrass and slender grama and by an increased growth of climax woody plants.

Eventually, under continued heavy use, the understory composition consists mainly of perennial threeawn and Texas bristlegrass. With no competition from strong

perennial grasses and no range fires, the brush canopy becomes very dense and is commonly dominated by guajillo and blackbrush.

At this stage of range deterioration, much of the ground is bare, permitting excessive moisture evaporation. The site, consequently, becomes more droughty.

Gray Loamy Upland Range Site

The Aguilares soil, map unit AgB, makes up this site. This soil is deep and has a low available water capacity.

The climax plant community on this range site is a semiopen grassland; scattered moderate canopies of brush make up 5 to 15 percent of the community. The brush canopies have been kept relatively open by periodic widespread range fires.

About 35 percent of the climax vegetation is twoflower and fourflower trichloris. About 15 percent is Arizona cottontop and lovegrass tridens; 25 percent is plains bristlegrass, pink pappusgrass, and silver bluestem; 5 percent is hooded windmillgrass and sand dropseed; and 5 percent is buffalograss and curlymesquite. Other grasses, which make up about 5 percent of the climax plant community, are slim tridens, perennial threeawn, fall witchgrass, and Texas bristlegrass. Forbs, including bundleflower, western ragweed, dalea, bushsunflower, and orange zexmenia, and some annual forbs make up about 5 percent. Woody plants, including guajillo, blackbrush, mesquite, huisache, lotebush, coma, granjeno, colima, coyotillo, guayacan, pricklypear, tasajillo, ephedra, narrowleaf elbowbush, cenizo, and paloverde, make up the remaining 5 percent.

As the range deteriorates from heavy and continuous grazing, twoflower and fourflower trichloris, Arizona cottontop, lovegrass tridens, many palatable perennial forbs are grazed out of the plant community.

Plants that initially increase as a result of range deterioration include plains bristlegrass, pink pappusgrass, and silver bluestem.

Eventually, if heavy use of the range continues, the understory composition consists mainly of Texas bristlegrass, Hall's panicum, red grama, threeawn, and many unpalatable perennial forbs, and annual forbs.

Continued overgrazing and the lack of periodic range fires result in a dense canopy of guajillo, blackbrush, pricklypear, mesquite, and other climax brush species. Goldenweed commonly forms thick canopies under these conditions.

At this stage of range deterioration, the soil surface becomes crusted, impeding the infiltration of rainfall and the germination of seeds. Because much of the site is bare, erosion is a severe hazard.

Gray Sandy Loam Range Site

The Copita soil, map unit CpB, makes up this site. This soil is moderately deep and has a low available water capacity.

The climax plant community is a semiopen grassland. Scattered brush in moderate canopies makes up 5 to 15 percent of the plant community. The brush canopy has been kept relatively open by periodic widespread range fires.

About 20 percent of the climax vegetation is tanglehead, twoflower trichloris, fourflower trichloris, and southwestern bristlegrass. About 10 percent is Arizona cottontop and silver bluestem, 5 percent is green sprangletop and lovegrass tridens, 30 percent is plains bristlegrass and pink pappusgrass, 15 percent is hooded windmillgrass and sand dropseed, and 5 percent is curlymesquite, buffalograss, and vine-mesquite. Other grasses, which make up about 5 percent of the climax plant community, are perennial threeawn, slim tridens, Texas bristlegrass, Hall's panicum, and fall witchgrass. Forbs, which include orange zexmenia, bushsunflower, bundleflower, snoutbean, sensitivebriar, and dalea, and some annual forbs make up about 5 percent. Woody plants also make up 5 percent of the climax vegetation. They include mesquite, whitebrush, granjeno, catclaw, Texas persimmon, Calderon ratany,

paloverde, false-mesquite, blackbrush, guajillo, colima, gray coldenia, brasil, kidneywood, huisache, lotebush, knifeleaf condalia, desert yaupon, ephedra, cenizo, coma, ebony, pricklypear, tasajillo, narrowleaf elbowbush, and guayacan.

As the range deteriorates from heavy and continuous grazing, the desirable grazing plants decrease and eventually are grazed out of the plant community. These plants include tanglehead, twoflower trichloris, fourflower trichloris, Arizona cottontop, green sprangletop, lovegrass tridens, southwestern bristlegrass, and many palatable perennial forbs.

Plants that initially increase as the range deteriorates further are plains bristlegrass, pink pappusgrass, and hooded windmillgrass.

Eventually, with continued heavy use of the range, the understory vegetation consists mainly of perennial threeawns, Texas bristlegrass, slim tridens, sandbur, Hall's panicum, and unpalatable forbs. Continued heavy use and a lack of periodic range fires result in a dense canopy of the climax brush species and infestations of goldenweed, ericameria, and perennial broomweed.

At this stage of range deterioration, the soil surface becomes crusted and compacted because large areas of the ground are bare. The hard surface impedes rainfall absorption and seed germination. Also, there is an increased hazard of erosion.

Loamy Bottomland Range Site

The Lagloria, Laredo, and Rio Grande soils, map units LgA, LgB, LrA, and Rg, make up this site. The soils are deep and have a medium to high available water capacity.

The climax plant community varies according to landscape position, but it generally consists of a somewhat open grassland that supports moderate canopies of trees and brush.

About 40 percent of the climax plant community is twoflower trichloris, fourflower trichloris, and Arizona cottontop. About 10 percent is big sandbur and southwestern bristlegrass, 5 percent is big sacaton, 10 percent is vine-mesquite and white tridens, and 15 percent is buffalograss, pink pappusgrass, plains bristlegrass, and hooded windmillgrass. About 5 percent is forbs, including dayflower, bundleflower, ruellia, Engelmann-daisy, and sensitivebriar, and some annual forbs.

Woody plants make up about 15 percent of the climax vegetation. They include mesquite, granjeno, retama, and huisache.

Deterioration of the climax plant community occurs if the site is subjected to heavy and continuous grazing. Plants such as twoflower trichloris, fourflower trichloris, Arizona cottontop, southwestern bristlegrass, big cenchrus, and big sacaton and palatable perennial forbs decrease and are eventually grazed out of the plant community.

Plants that initially increase under heavy, continuous grazing include pink pappusgrass, plains bristlegrass, hooded windmillgrass, bermudagrass, and the less palatable forbs and brush.

Eventually, as the range deteriorates further, such grasses as whorled dropseed, red grama, threeawns, fringed signalgrass, Hall's panicum, and Texas bristlegrass and unpalatable forbs and goldenweed dominate the site. In the absence of competition from strong perennial grasses and with no periodic range fires, the brush canopy becomes dense with the climax brush types.

At this stage of deterioration, much of the ground is bare, and the soil begins to crust. The hard surface impedes the absorption of rainfall and the germination of seeds. Also, the hazard of erosion is increased.

The Rio Grande soils that are near the river generally are wetter than the other soils in this range site, and they are subject to flooding. Because of the moist conditions, the vegetation in this area is dominated by common reed, giant reed, big

sacaton, and other tall grasses and by spiny aster. There are trees and brush, and in places they form thickets. Woody plants include hackberry, Rio Grande ash, willow, mesquite, baccharis, retama, huisache, and Texas persimmon.

Loamy Sand Range Site

The Comitas and Delfina soils, map units CoB and DeB, make up this site. These soils are deep and have a medium available water capacity. They absorb rainfall readily.

The climax plant community is an open grassland that supports scattered motts of mesquite trees and brush. Periodic range fires have been responsible for keeping the site open.

About 25 percent of the climax vegetation is seacoast bluestem, brownseed paspalum, and crinkleawn. About 40 percent is tanglehead, Arizona cottontop, silver bluestem, fourflower trichloris, and southwestern bristlegrass; 15 percent is knotroot bristlegrass, hooded windmillgrass, sand dropseed, and plains bristlegrass; and 5 percent is balsamscale and perennial threeawn. About 5 percent is other grasses, including fall witchgrass, slender grama, and fringeleaf paspalum. Forbs make up about 5 percent of the climax plant community. They include snoutbean, sensitivebriar, western indigo, milkpea, dayflower, orange zexmenia, bushsunflower, verbena, and sida as well as some annual forbs.

Woody plants make up no more than 5 percent of the climax production. The plants are mesquite, catclaw, brasil, granjeno, hogplum, amargoso, guayacan, and lantana.

The condition of the range deteriorates under heavy and continuous grazing. The first plants that decrease and eventually are grazed out are seacoast bluestem, crinkleawn, brownseed paspalum, Arizona cottontop, tanglehead, fourflower trichloris, and the most palatable forbs. These plants are replaced initially by hooded windmillgrass, sand dropseed, fall witchgrass, slender grama, knotroot bristlegrass, and the less palatable forbs and brush. In some areas, balsamscale completely dominates at this stage of range deterioration.

Eventually, with continued heavy use, the understory consists mainly of grassbur, red lovegrass, fringed signalgrass, tumble lovegrass, threeawn, annual grasses, and unpalatable forbs, including camphorweed, cowpen daisy, and wild buckwheat. Heavy grazing and a lack of periodic range fires can increase the brush canopy to a moderate level.

At this stage of range deterioration, much of the ground is bare, leaving the soil susceptible to wind erosion.

Lowland Range Site

The Arroyada soil, map unit Ar, makes up this site. This soil is deep and saline. It has a low available water capacity and a water table that fluctuates within the rooting zone.

The climax plant community consists of an open grassland that has little or no brush canopy.

About 85 percent of the climax vegetation is gulf cordgrass (also called sacahuista). About 5 percent is big sacaton; 5 percent is Hartweg paspalum, white tridens, and silver bluestem; and about 5 percent is vine-mesquite, buffalograss, curlymesquite, and shoregrass. Forbs make up an insignificant part of the vegetation. Woody plants, such as mesquite, retama, spiny aster, and screwbean, are present, but they also make up an insignificant part of the climax vegetation.

The dominant vegetation, gulf cordgrass, does not greatly decrease under continuous grazing because it is normally quite unpalatable to cattle. This range site in most places is associated with other range sites that support more palatable forage. Consequently, this site generally is seldom grazed.

When the gulf cordgrass is burned (usually in the fall or winter), the young and tender regrowth is attractive to cattle, and cattle graze it readily in winter and early in spring. If burning and heavy grazing are practiced annually on this site, the gulf cordgrass decreases along with the other climax grasses. These plants are replaced by unpalatable salt-tolerant perennial and annual forbs, woody plants, and grasses, including whorled dropseed.

At this stage of range deterioration, cattle tend not to graze the site, and gulf cordgrass spreads back into the area.

Ramadero Range Site

The Tela soil, map unit Te, makes up this site. This soil is deep and has a high available water capacity. The soil receives extra water from surrounding soils and from flooding.

The climax plant community is a semiopen riparian savannah that has understory of productive grasses and moderate canopies of trees and tall brush. Periodic range fires have been responsible for keeping the brush canopy open.

About 40 percent of the climax vegetation is twoflower and fourflower trichloris. About 10 percent is Arizona cottontop, 10 percent is southwestern bristlegrass and cane bluestem, 5 percent is lovegrass tridens and big cenchrus, 10 percent is plains bristlegrass and pink pappusgrass, 5 percent is curlymesquite and buffalograss, 5 percent is vine-mesquite, and 5 percent is hooded windmillgrass. Forbs, such as Engelmann-daisy, bushsunflower, western ragweed, orange zexmenia, bundleflower, ruellia, and dayflower, and annual forbs make up about 5 percent.

Trees and brush, including mesquite, hackberry, granjeno, huisache, persimmon, coma, coyotillo, whitebrush, colima, brasil, kidneywood, pricklypear, guayacan, tasajillo, Texas persimmon, ephedra, and baccharis, make up the remaining 5 percent.

The climax plant community deteriorates under heavy and continuous grazing. Initially, twoflower trichloris and fourflower trichloris, Arizona cottontop, southwestern bristlegrass, cane bluestem, lovegrass tridens, big cenchrus, and the most palatable forbs decrease and are eventually grazed out of the plant community. As the desirable plants decrease, they are replaced by plains bristlegrass, pink pappusgrass, curlymesquite, buffalograss, hooded windmillgrass, and the less palatable forbs and brush.

Eventually, with continued heavy grazing, the understory consists mainly of Hall's panicum, Texas bristlegrass, whorled dropseed, threeawn, tumblegrass, and unpalatable perennial and annual forbs. With no periodic range fires, overgrazing results in a dense, impenetrable thicket of mesquite, whitebrush, and other climax brush species.

At this stage of range deterioration, the soil forms a crust that limits rainfall penetration and seedling germination. Also, the soil is subject to severe erosion.

Red Sandy Loam Range Site

The Delmita soil, map units DmB and DRB, makes up this range site. This soil is moderately deep and has a low available water capacity. It absorbs rainfall readily.

The climax plant community is a semiopen grassland. Scattered brush canopies make up 5 to 10 percent of the plant community. The canopy has been kept relatively open by periodic, widespread range fires.

About 35 percent of the climax vegetation is Arizona cottontop, fourflower trichloris, and tanglehead. About 10 percent is silver bluestem, 10 percent is fringeleaf paspalum and slender grama, 10 percent is hooded windmillgrass, 5 percent is plains bristlegrass, and 5 percent is perennial threeawn. Other grasses, which make up about 10 percent of the climax vegetation, are slim tridens, hairy grama, knotroot panicum, fall witchgrass, and Texas bristlegrass. Forbs, including

scurfpea, partridgepea, sensitivebriar, western indigo, bundleflower, snoutbean, dalea, bushsunflower, orange zexmenia, and menodora, and some annual forbs make up about 10 percent. About 5 percent of the vegetation is woody plants. The plants are mesquite, blackbrush, kidneywood, huisache, colima, catclaw, granjeno, agarita, lotebush, brasil, mescal bean, hogplum, guayacan, desert yaupon, pricklypear, narrowleaf elbowbush, coma, Texas persimmon, and ephedra.

As the range condition deteriorates from heavy and continuous grazing, Arizona cottontop, fourflower trichloris, tanglehead, and many palatable perennial forbs are grazed out of the plant community. These plants are replaced initially by slender grama, fringeleaf paspalum, hooded windmillgrass, and plains bristlegrass.

As the range condition continues to deteriorate, the understory composition consists mainly of perennial threeawn, hairy grama, Texas bristlegrass, sandbur, red lovegrass, tumblegrass, and many unpalatable perennial and annual forbs.

If there are no periodic range fires, long-term overgrazing results in a dense canopy of mesquite, blackbrush, and other climax brush species and perennial broomweed.

At this stage of range deterioration, much of the ground is bare, leaving the soil susceptible to erosion.

Rolling Hardland Range Site

The Maverick soil, map unit MCE, makes up this site. This soil is moderately deep and saline. It has a very low available water capacity.

The climax plant community is a semiopen grassland. Scattered low brush in thin canopies covers up to 10 percent of the range site. The brush canopies have been kept relatively open by periodic widespread range fires.

About 25 percent of the climax vegetation is twoflower trichloris, fourflower trichloris, and Arizona cottontop. About 20 percent is plains bristlegrass and pink pappusgrass, 10 percent is alkali sacaton, 15 percent is curlymesquite and buffalograss, 5 percent is tobosa, and 5 percent is lovegrass tridens and bush muhly. Other grasses make up about 10 percent of the climax vegetation. They are fall witchgrass, slim tridens, perennial threeawn, bristle panicum, and Texas bristlegrass. Forbs, including bushsunflower, orange about 5 percent. Woody plants, such as blackbrush, twisted acacia, and Wright's acacia, make up the remaining 5 percent.

As the range deteriorates from heavy and continuous grazing, twoflower trichloris, fourflower trichloris, Arizona cottontop, bush muhly, lovegrass tridens, alkali sacaton, and many palatable perennial forbs decrease and are eventually grazed out of the plant community. These plants are replaced initially by pink pappusgrass and plains bristlegrass and later by significant amounts of curly mesquite and tobosa.

Eventually, under continued heavy use, the understory consists mainly of red grama, Hall's panicum, whorled dropseed, Texas bristlegrass, slim tridens, and some unpalatable forbs. Saladilla invades the more abused areas. Overuse and an absence of periodic range fires result in a moderate to thick canopy of blackbrush, guajillo, and other climax brush species. Goldenweed and ericameria also invade under these conditions.

At this stage of range deterioration, significantly large areas are bare, and surface crusting results. The hard surface impedes rainfall infiltration. Evaporation increases, causing salts in the subsoil to rise nearer to the surface. Water erosion also becomes a severe problem.

Saline Clay Range Site

The Catarina and Viboras soils, map units CaB, CfA, MCE, and VrB, make up this site. These soils are deep to moderately deep and are saline. They have a low or very low available water capacity.

The climax or potential plant community on this site is a generally open grassland. Scattered low brush forms thin canopies that cover up to 5 percent of the range site. The brush canopies have been kept relatively open by periodic widespread range fires and by the high salinity of the soils, which tends to stunt the growth of the brush.

About 25 percent of the climax plant community is pink pappusgrass and plains bristlegrass. About 5 percent is alkali sacaton, 5 percent is Arizona cottontop and lovegrass tridens, 30 percent is curlymesquite and tobosa, and 15 percent is vine-mesquite, buffalograss, white tridens, and big sacaton. Other grasses make up about 10 percent of the climax vegetation. They are fall witchgrass, slim tridens, perennial threeawn, whorled dropseed, and Texas bristlegrass. Forbs, including bundleflower, orange zexmenia, bushsunflower, and saladilla, and some annual forbs make up about 5 percent. Woody plants make up 5 percent of the plant community. The plants are mesquite, granjeno, whitebrush, guayacan, fourwing saltbush, lotebush, amargoso, pricklypear, tasajillo, huisache, screwbean, and twisted acacia.

As the climax plant community deteriorates under heavy and continuous grazing, twoflower trichloris, Arizona cottontop, alkali sacaton, and the more palatable perennial forbs decrease and eventually are grazed out of the plant community. These plants are replaced initially by pink pappusgrass and plains bristlegrass and later by curlymesquite and, in places, tobosa.

Eventually, under continued heavy use, the understory consists mainly of a thin blanket of curlymesquite and significant amounts of red grama, whorled dropseed, Hall's panicum, and some forbs, including bitterweed and coneflower.

If there are no periodic range fires, continued overuse results in a moderate canopy of mesquite and other climax brush species. Thick canopies of goldenweed commonly invade under these conditions.

At this stage of range deterioration, significantly large areas are bare, and the soil begins to crust. Because of the crusting, less water is absorbed by the soil and more water runs off the soil. Thus, there is an increased hazard of erosion. Evaporation at the surface increases, causing salts in the subsoil to rise nearer to the surface. Consequently, the site becomes more droughty.

Sandy Range Site

The Nueces soil, map unit NuB, makes up this site. This soil is deep. It absorbs rainfall readily and has a medium available water capacity.

The climax plant community on this site is an open grassland that supports only occasional motts of brush or trees (fig. 18). Periodic range fires have been a major factor in keeping this site open.

About 55 percent of the climax plant community is seacoast bluestem. About 10 percent is crinkleawn; 5 percent is tanglehead; 5 percent is brownseed paspalum; 5 percent is fringeleaf paspalum; 5 percent is balsamscale, sand dropseed, and perennial threeawn; 5 percent is fall witchgrass; and 5 percent is hooded windmillgrass and knotroot panicum. Perennial and annual forbs make up about 5 percent of the climax vegetation. They include snoutbean, western indigo, sensitivebriar, dalea, neptunia, partridgepea, croton, snakecotton, and horsemint.

Brush, including mesquite, catclaw, lantana, brasil, and cactus, makes up an insignificant amount of the production of the climax plant community.

The range condition deteriorates under continued heavy grazing. The first plants to decrease are seacoast bluestem and crinkleawn. As these plants are being grazed out, other plants take their place. These include balsamscale, sand dropseed, knotroot panicum, perennial threeawn, and perennial and annual forbs.



Figure 18.—Typical vegetation on the Sandy range site. The dominant grasses are seacoast bluestem and crinkleawn. The soil is Nueces fine sand, 0 to 3 percent slopes.

Eventually, with continuous and heavy grazing by cattle, the site is dominated by plants such as red lovegrass, grassbur, fringed signalgrass, tumble lovegrass, hairy grama, camphorweed, croton, horsemint, and many other weedy kinds of forbs. The proportion of brush also increases.

At this stage of range deterioration, much of the ground is bare, leaving the soil susceptible to wind erosion.

Sandy Loam Range Site

The Brystal, Duval, and Hebbronville soils, map units BrB, DvB, and HeB, make up this site. These soils are deep. They absorb rainfall readily and have a medium available water capacity.

The climax plant community is a fairly open grassland. Scattered brush and mesquite trees form a canopy that covers up to about 5 percent of the range site. The brush has been kept at the same level by periodic, widespread range fires.

About 30 percent of the climax vegetation is fourflower trichloris and tanglehead; about 20 percent is Arizona cottontop, lovegrass tridens, southwestern bristlegrass, and silver bluestem; 10 percent is plains bristlegrass and slender grama; 10 percent is hooded windmillgrass and sand dropseed; and 10 percent is pink pappusgrass.

About 10 percent is other grasses, including slim tridens, Texas bristlegrass, knotroot bristlegrass, perennial threeawn, fall witchgrass, gummy lovegrass, hairy grama, and fringeleaf paspalum. About 5 percent is forbs, including western indigo, sensitivebriar, bundleflower, milkpea, dalea, neptunia, roundleaf tephrosia, dayflower, orange zexmenia, and bushsunflower, and some annual forbs.

Woody plants, including mesquite, brasil, granjeno, huisache, colima, whitebrush, catclaw, lotebush, pricklypear, littleleaf sumac, wolfberry, desert yaupon, guayacan, narrowleaf elbowbush, kidneywood, Texas persimmon, and ephedra, make up the remaining 5 percent.

As the range deteriorates from heavy and continuous grazing, fourflower trichloris, tanglehead, Arizona cottontop, southwestern bristlegrass, lovegrass tridens, and many palatable perennial forbs decrease and are eventually grazed out of the plant community. These plants are initially replaced by plains bristlegrass, slender grama, hooded windmillgrass, sand dropseed, and pink pappusgrass.

Eventually, with continued heavy use of the range and further deterioration, the understory consists mainly of annual forbs, such as sunflower and cowpen daisy, unpalatable perennial forbs, red lovegrass, red grama, Hall's panicum, grassbur, Texas bristlegrass, and goldenweed. Continuous overgrazing and a lack of periodic range fires result in a dense canopy of mesquite and other climax brush species, along with an increase of goldenweed (fig. 19).

At this stage of range deterioration, significantly large areas are bare, and the soil begins to crust. Because of the crusting, less water is absorbed by the soil and more water runs off the soil. Thus, there is an increased hazard of erosion.

Shallow Ridge Range Site

The Nido, Nido Variant, and Zapata soils, map units NDF, NOC, and ZAC, make up this site. These soils are very shallow and have a very low available water capacity.

The potential plant community on this site is a semiopen chaparral or shrubland that has an understory of mid and short grasses.

About 25 percent of the climax plant community is Arizona cottontop and pink pappusgrass. About 15 percent is tanglehead, green sprangletop, and bush muhly; 10 percent is silver bluestem; 10 percent is plains bristlegrass; 5 percent is lovegrass



Figure 19.—An area of Duval fine sandy loam, 0 to 3 percent slopes, in the Sandy Loam range site. The principal brush species are mesquite, tasajillo, condalia, and coyotillo.

tridens and plains lovegrass; and 5 percent is buffalograss and curlymesquite. About 15 percent is other grasses, including fall witchgrass, slim tridens, perennial threeawn, hairy grama, and Texas bristlegrass. About 5 percent of the climax production consists of forbs, including orange zexmenia, skeletonleaf goldeneye, bushsunflower, halfshrub sundrop, menodora, and Dutchman's breeches, and some annual forbs.

Woody plants make up about 10 percent of the climax plant community. They include guajillo, blackbrush, cenizo, ephedra, feather dalea, guayacan, false-mesquite, lotebush, kidneywood, screwbean, Calderon ratany, shrubby blue sage, softleaf mimosa, and smallflower peachbrush.

The brush canopy remained moderate in the climax condition because of relatively low grass production. The low amount of vegetation in most years was not enough to fuel frequent range fires that would have kept the canopy more open.

Deterioration of the climax plant community occurs as the site is subjected to heavy and continuous grazing. As the range deteriorates, Arizona cottontop, tanglehead, green sprangletop, bush muhly, lovegrass tridens, plains lovegrass, and the most palatable forbs decrease and are eventually grazed out. These plants are initially replaced by pink pappusgrass, plains bristlegrass, silver bluestem, and some of the less palatable forbs. With continued heavy grazing, the plant community is dominated by threeawn, fall witchgrass, hairy grama, slim tridens, unpalatable forbs, and an abundance of shrubs or brush.

In the final stages of range deterioration, much of the ground is bare, and the soil is susceptible to erosion. In addition to low brush, which dominates the range site, only unpalatable grasses and forbs of very low quality are present.

Shallow Sandy Loam Range Site

The Cuevitas, Dilley, Randado, and Verick soils, map units CRB, DsB, DRB, and VkC, make up this site. These soils are very shallow to shallow. They absorb rainfall readily and have a very low available water capacity.

The climax or potential plant community is a partly open grassland that supports moderate canopies of low shrubs.

About 30 percent of the climax vegetation is silver bluestem, tanglehead, and Arizona cottontop. About 10 percent is plains bristlegrass and pink pappusgrass; 15 percent is hooded windmillgrass, sand dropseed, and slender grama; 10 percent is perennial threeawn and slim tridens; and 5 percent is fall witchgrass. Other grasses, which make up about 10 percent of the climax vegetation, include gummy lovegrass, Texas tridens, hairy tridens, and red grama.

Perennial forbs make up about 5 percent of the climax vegetation. They include orange zexmenia, skeletonleaf goldeneye, dayflower, bushsunflower, rockdaisy, dalea, menodora, and halfshrub sundrop. A variety of annual forbs also make up about 5 percent of the climax plant community.

Woody shrubs, such as guajillo, blackbrush, kidneywood, coyotillo, lotebush, guayacan, desert yaupon, mesquite, littleleaf sumac, cenizo, shrubby blue sage, narrowleaf elbowbush, Berlandier croton, ephedra, knifeleaf condalia, pricklypear, and tasajillo, make up the remaining 10 percent (fig. 20).

The brush canopy remained moderate because the relatively low grass production was not enough to fuel the range fires that would have kept the canopy more open.

Deterioration of the plant community occurs as the site is heavily and continuously grazed. As the range deteriorates, silver bluestem, tanglehead, Arizona cottontop, and most palatable perennial forbs are grazed out of the plant community. These plants are initially replaced by plains bristlegrass, pink pappusgrass, hooded windmillgrass, sand dropseed, slender grama, fall witchgrass, less palatable forbs, and an increased growth of shrubs.

Eventually, as heavy use of the range continues, the understory consists mainly of perennial threeawn, slim tridens, hairy tridens, red grama, red lovegrass, sandbur, gummy lovegrass, Hall's panicum, many unpalatable perennial forbs, and annual forbs. In the absence of competition from strong perennial grasses and with no periodic range fires, the shrub canopy becomes dense.

At this stage of range deterioration, significantly large areas are bare, and the soil begins to crust. Because of the crusting, less water is absorbed by the soil and more water runs off the soil. Thus, there is an increased hazard of erosion.



Figure 20.—The dominant brush species in this area of the Shallow Sandy Loam range site are cenizo, guajillo, blackbrush, and guayacan. The soils are in the Cuevitas-Randado complex, gently undulating.

Crops and Pasture

The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified in this section.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units". Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Agricultural Extension Service.

In 1980, about 3,000 acres in Webb County was used for crops. Most of this acreage was irrigated cropland. The main crops were vegetables and grain sorghum.

Acreage in crops has been decreasing as more and more land is used for urban development, especially in the Laredo area. In 1950, irrigated cropland totaled about 20,000 acres, according to local Soil Conservation Service figures.

The soils in Webb County have low potential for increased production of crops unless new sources of irrigation water can be found. Rainfall is insufficient for dryland farming during the growing season in most years.

Field crops that grow well in the soils and climate of Webb County are cotton (estimated irrigated yields are 800 to 1,000 pounds lint per acre), grain sorghum (irrigated yields are 75 to 130 bushels per acre), and corn (irrigated yields are 80 to 100 bushels per acre). Other crops can be grown if prices are favorable.

Specialty crops grown commercially in the county are vegetables, melons, and nursery plants. Some of the vegetables commonly grown are tomatoes, carrots, lettuce, onions, and cantaloupes.

Information about specialty crops is available at the local office of the Agricultural Extension Service or the Soil Conservation Service.

In general, the soils in the county that are well suited to crops are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use patterns.

About 2,000 acres in Webb County was used for pasture in 1980. Introduced species of perennial grasses are planted and are grazed by livestock or are harvested as hay. The main pasture grasses are buffelgrass, kleingrass, coastal bermudagrass, kleburg bluestem, and blue panicum.

Use of the Soils for Wildlife

By Stephen Nelle, range conservationist, Soil Conservation Service.

The rangeland in Webb County serves the dual function of livestock production and habitat for various kinds of wildlife. Nearly all ranching operations derive some income or related benefits from the leasing of hunting rights or from guest hunting.

Most ranchers are paying closer attention to the needs of wildlife on their rangeland mainly because income from hunting leases is continuing to increase, whereas income from cattle is erratic and unpredictable. On many ranches, the net income from hunting leases is equal to the net income from cattle sales. For this reason, the proper management of wildlife and wildlife habitat is an important concern.

The basic habitat requirements for any wildlife population are food, cover, and water. Each species of wildlife has individual food, cover, and water requirements. In order for wildlife to inhabit an area, the land must either naturally meet the habitat requirements or it must be managed so that the proper habitat requirements are supplied.

Soils affect the kind and amount of vegetation that is available to wildlife for food and cover. Soils also influence the distribution of surface water for wildlife use. However, in most cases the past and present management of the soils has a much greater influence on wildlife habitat than do the soils themselves. In the survey area, the management practices that greatly affect wildlife habitat include past and present grazing management, past and present brush control, the patterns and methods of this control, and the species used in range seeding. The carrying capacity of an area for deer, javelina, or quail is directly dependent on these factors.

The soils in the survey area are grouped into range sites according to the kinds, proportions, and amounts of vegetation that the soils can support. These range sites have individual characteristics, and they vary in their ability to meet the habitat needs of specific kinds of wildlife. Each range site can be managed in ways that either benefit or harm the wildlife habitat. Therefore, a knowledge of soils and range sites is essential to the proper management of wildlife habitat. For additional information on range sites, refer to the rangeland section of this soil survey.

The kinds of wildlife that are economically important in Webb County include white-tailed deer, javelina, bobwhite quail, scaled quail, mourning dove, whitewing dove, and various game fish.

White-tailed deer is by far the most important game animal in Webb County. This region of Texas is a large area where deer herds of high quality still exist. The quality and numbers of deer depend largely upon the range management and deer harvest management practiced in the area.

The two practices most damaging to deer habitat in the county are heavy and continuous grazing by cattle and indiscriminate large-scale brush clearing. These practices reduce the ability of the rangeland to support deer.

Deer, javelina, and, to some extent, quail depend upon brushy cover for a large part of their home range. Brush provides deer much of their diet as well as cover. Some of the more valuable brush plants that provide deer with browse and cover are granjeno, colima, guajillo, guayacan, brasil, blackbrush, mesquite, lotebush, and pricklypear.

On well managed rangeland, forbs commonly provide the bulk of forage for deer during most of the year. Several of the more palatable perennial forbs are ragweed, groundcherry, dalea, dayflower, bushsunflower, orange zexmenia, and velvet bundleflower. Annual forbs, which are important in wet years, are tallow weed, bladderpod, deervetch, lazy daisy, and gaura.

Even though cattle are primarily grass eaters, they eat a great deal of forbs and browse, especially if more cattle are grazing than an area can safely carry. When too

many cattle are in a given area, they compete with deer for the choice forbs and browse. The deer are forced to eat less desirable forage and the nutritional quality of their diet declines. A sound range management program is essential for a good deer management program.

Deer prefer to feed close to suitable cover. The removal of large areas of brush, therefore, is detrimental to deer herds. Many landowners, recognizing the need to conserve their deer habitat have begun to manage brush in patterns designed to leave adequate brushy cover near all cleared areas.

The most common management practice is to clear brush in strips, leaving alternating strips of brush and open space (fig. 21). Brush patterns create extensive edge areas between cleared areas and brushy cover. Edge areas not only maintain but improve deer habitat.



Figure 21.—An area where the brush has been cleared in strips. This practice benefits both cattle and wildlife. The soil is Aguilares sandy clay loam, 0 to 3 percent slopes. The seeded grass is kleingrass.

Javelina are also vulnerable to extensive brush clearing. These animals prefer dense brush that contains at least a moderate amount of pricklypear, which is their primary food item. Whitebrush thickets along drainage areas are especially good habitat for javelina. Javelina have virtually disappeared from areas where brush has been cleared extensively, but their numbers are increasing in areas where landowners perform brush management in patterns.

The presence of both bobwhite quail and scaled quail during the hunting season depends largely upon the amount of rainfall received during the prime nesting months of May and June. In the first several weeks of life, young quail rely heavily on insects for their food supply. After that, they must have an adequate supply of seeds to eat. Some of the more nutritious seed-producing plants valuable to quail are croton, ragweed, bundleflower, bristlegass, sunflower, pricklypoppy, tallow weed, and bladderpod. The fruits and seeds of cactus and some brush plants are also important, especially to scaled quail.

Mourning dove are common throughout the county both as resident and migrating birds. Whitewing dove numbers are erratic, but sufficient populations for hunting are generally present along the Rio Grande. These birds are drawn in numbers to areas where grain sorghum, croton, and sunflower grow in abundance.

Migrating waterfowl are common in Webb County throughout the fall and winter. They feed mainly near old, partly silted-in ponds. Such aquatic plants as muskgrass, pondweed, spikerush, and barnyardgrass are major food items for ducks. Common ducks in this area include bluewing and greenwing teal, gadwall, widgeon, pintail, shoveler, and some canvasback. Black-bellied tree ducks nest in Webb County and are found on several of the larger lakes.

White-fronted and Canada geese are the only kinds of geese that frequent the area. They are generally found near the larger lakes and feed on the shorelines for young, tender leafy forage.

Some of the commonly seen nongame animals in Webb County are jackrabbit, cottontail rabbit, Mexican ground squirrel, and coyote. Other animals include badger, raccoon, skunk, several kinds of bats, mice, rats, gopher, bobcat, and cougar.

Raptorial birds-of-prey common in Webb County are buteo, falcon, kite, and owl. Roadrunners are numerous.

The most common carrion-eating birds are the turkey vulture, caracara, and white-necked raven.

Non-game birds found on Webb County rangelands are dove, cuckoo, nighthawk, swift, hummingbird, woodpecker, flycatcher, lark, swallow, jay, titmouse, wren, thrasher, gnatcatcher, waxwing, shrike, starling, vireo, warbler, finch, sparrow, oriole, and tanager.

Birds associated with ponds and lakes are several species of heron and egret, gallinule, coot, plover, sandpiper, dowitcher, avocet, curlew, gull, tern, anhinga, cormorant, and grebe. White pelican is often seen on larger lakes. Many of the birds seen in Webb County are not yearlong residents; they migrate to or through the area.

Common reptiles in Webb County include the Western diamondback rattlesnake, indigo snake, whiptail lizard, horned lizard, and Texas tortoise. Many other kinds of snakes, lizards, turtles, and tortoises inhabit Webb County but to a lesser extent.

Amphibians are limited to ponds, seasonally wet places, and nearby areas. Several kinds of frogs, toads, and salamanders live in Webb County.

The estimated 2,500 ponds and lakes in Webb County provide excellent resources for fish production. Once constructed, these bodies of water are generally stocked with fish. The most commonly stocked game species of fish are largemouth bass and channel catfish. Bluegill sunfish and fathead minnow are generally stocked as food for the game fish. Hybrid sunfish are also commonly stocked alone or with other fish.

Flathead or yellow-catfish are sometimes stocked in an effort to keep prey fish populations from exploding. Crappie are sometimes stocked in larger lakes of 10 or more surface acres.

After several years these ponds generally have acquired unacceptable levels of several undesirable fish species. These include bullhead catfish, green sunfish, gizzard shad, gar, buffalo, carp, and various other prolific members of the minnow family.

All of these game and nongame species of wildlife, no matter how small in size or in relative importance, are essential parts of the ecosystem where they are found. The existence and habits of each plant or animal affect the life cycles of many other co-existing plants and animals. Animals and plants that we think of as unimportant may be vital links in the food chain or cover requirements of another creature that humans consider more important.

Gardening and Landscaping

In general, the soils in Webb County are well suited to many flowers, shrubs, and trees. Nevertheless, homeowners in the county need a dependable supply of high-quality irrigation water to grow flowers, shrubs, and trees other than those native to the area. Rainfall is generally inadequate or poorly distributed during the growing season.

Homeowners need to know the kinds of soil they have and the kinds of flowers, shrubs, and trees that grow best on those soils.

Soils that are well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter, and good drainage. In Webb County, most soils are alkaline; therefore, plants that grow in alkaline soils should be selected. Some plants grown in calcareous, alkaline soils develop chlorosis, which causes plant leaves to turn yellow. Chlorosis is caused by an iron deficiency and can generally be corrected by adding iron to the soil.

Table 9 lists the soils in Webb County and some of the flowers, shrubs, and trees that are suited to each soil.

Generally, it is less expensive to condition the natural soil than to replace it with manmade soil material. Soil amendments and fertilizer should be added according to the results of soil tests and the needs of the plants. Organic matter is an important addition to most soils. It can be added as peat moss, compost, decomposed sawdust, or manure. At least 2 inches of sand, perlite, or vermiculite should be added to clayey soils. Elemental sulphur or ammonium sulfate can be added to help neutralize a high lime soil. All plants, whether grown in natural or manmade soil, require careful maintenance, especially during the period of establishment. Good management practices include fertilizing, watering, controlling weeds, and controlling insects. The main factors that affect gardening in Webb County are long hot spells, high alkalinity of the soils, and soluble salts in the irrigation water.

Gardening and landscaping should be included in the basic plans for urban construction. The potential of the soil for plants should be considered in selecting a construction site. Where possible, existing trees should be protected during construction. Large, healthy trees are valuable to the property. For more detailed guidance on gardening and landscaping, consult the nearest office of the Soil Conservation Service or the Agricultural Extension Service.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and by the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 8.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations must be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey,

determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly

impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excessive gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plant growth. Material from the surface layer, therefore, should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet.

Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology".

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent,

an appropriate modifier is added, for example, “gravelly”. Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease

of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is

based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (LISLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy foams, fine sandy foams, and very fine sandy foams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
- 4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay foams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay foams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay barns that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An apparent water table is the only kind that occurs in the soils of Webb County.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17 and the results of chemical and other analyses in table 16. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology". Soil samples were analyzed by the National Soil Survey Laboratory, Lincoln, Nebraska, and the Soil Characterization Laboratory, Texas Agricultural Experiment Station, Texas A&M University.

Most determinations, except those for grain-size analysis, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (13).

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all materials less than 75 mm (3B1).

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).

Carbonate clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1a).

Fine clay—(fraction less than 0.002 mm) pipette-centrifuge extraction, weight percentages of materials less than 2 mm (3A1b).

Water retained—pressure extraction, percentage of oven-dry weight of less than 2 mm material; 15 bars (4B2).

Organic carbon—dichromate, ferric sulfate titration (6A1c).

Cation-exchange capacity—ammonium acetate, pH 7.0 (5A6a).

Reaction (pH)—1:1 water dilution (8C1a).

Reaction (pH)—calcium chloride (8C1e).

Carbonate as calcium carbonate—manometric (6E1b).

Electrical conductivity—saturation extract (8A1a).

Exchangeable sodium percentage (5D2).

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section “Soil Series and Their Morphology”. The soil samples were tested by the Texas Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle index)—T100 (AASHTO), D653 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (15).

Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ustifluvents (*Ust*, meaning burnt and connoting a Ustic moisture regime, plus *fluvent*, the suborder of the Entisols that formed in recent river deposited sediments).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ustifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-silty, mixed, calcareous, hyperthermic Typic Ustifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (12). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (14). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each, soil series are described in the section "Detailed Soil Map Units".

Aguilares Series

The Aguilares series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy sediments. Slopes range from 0 to 3 percent.

Typical pedon of Aguilares sandy clay loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 36.6 miles northeast on U.S. Highway 59 to intersection of Welhausen Road, 4.25 miles east on U.S. Highway 59, 50 feet south of fence, in rangeland:

A—0 to 8 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky and weak fine granular; slightly hard, friable; hard, friable surface crust 1 inch thick; many fine roots; common fine and medium pores; 9 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear smooth boundary.

Bk1—8 to 13 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; common fine and medium roots; few fine and medium pores; few threads and films of

calcium carbonate; 15 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

Bk2—13 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; few fine roots; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; 20 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

Bk3—23 to 36 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; about 10 percent, by volume, threads, films, and soft masses of calcium carbonate; about 35 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

Cknz1—36 to 46 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; few fine and very fine roots; about 10 percent, by volume, threads, films, and soft masses of calcium carbonate; about 31 percent calcium carbonate equivalent; saline; exchangeable sodium percentage is about 18; calcareous; moderately alkaline; gradual wavy boundary.

Cknz2—46 to 59 inches; very pale brown (10YR 8/3) sandy clay loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; about 15 percent, by volume, light gray (5Y 7/2) weakly cemented sandstone fragments that slake upon wetting; few fine and very fine roots; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; about 26 percent calcium carbonate equivalent; saline; exchangeable sodium percentage is about 25; calcareous; moderately alkaline; clear wavy boundary.

Cknyz—59 to 72 inches; very pale brown (10YR 8/3) sandy clay loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; about 30 percent, by volume, light gray (5Y 7/2) weakly cemented sandstone fragments that slake upon wetting; few very fine roots; about 3 percent, by volume, threads, films, and soft masses of calcium carbonate; about 17 percent calcium carbonate equivalent; about 10 percent, by volume, soft masses and crystals of gypsum and other salts; saline; exchangeable sodium percentage is about 22; calcareous; moderately alkaline.

Solum thickness ranges from 30 to 50 inches. Total clay content in the 10- to 40-inch control section ranges from 25 to 40 percent, and silicate clay content ranges from 18 to 30 percent. Calcium carbonate equivalent in the control section averages 10 to 25 percent. The depth to the calcic horizon ranges from 10 to 35 inches. Calcium carbonate equivalent in the calcic horizon ranges from 15 to 35 percent, 5 to 15 percent of which is in visible secondary forms. Crystalline gypsum and other salts make up 0 to 20 percent of the volume and occur below a depth of 40 inches. Electrical conductivity is less than 4 mmhos/cm at 25°C in the upper 30 inches. Electrical conductivity increases with depth and ranges from 4 mmhos/cm to more than 16 mmhos/cm at 25°C below a depth of 30 inches. The exchangeable sodium percentage ranges from 15 to 30 percent below a depth of 30 inches. Siliceous pebbles make up 0 to 15 percent of the volume of any horizon.

The A horizon is light brownish gray, grayish brown, dark grayish brown, pale brown, or brown. Where the soil is moist and the value is less than 3.5, the A horizon is less than 7 inches thick. The total clay content ranges from 15 to 30 percent. The A horizon is calcareous or noncalcareous but is calcareous when the upper 7 inches are mixed.

The B horizon is light gray, light brownish gray, grayish brown, very pale brown, pale brown, brown, light yellowish brown, yellowish brown, pinkish gray, pink, or light brown. It is sandy clay loam or clay loam that has a total clay content of 20 to 40 percent and a carbonate clay content of 1 to 25 percent.

The C horizon is very pale brown, pale brown, light yellowish brown, light brown, or pink. It is fine sandy loam, sandy clay loam, or clay loam that has a total clay content of 10 to 38 percent and a carbonate clay content ranging from a trace to 20 percent. Weakly to strongly cemented sandstone in the C horizon ranges from 0 to 35 percent, by volume, and occurs below a depth of 40 inches. Most sandstone fragments slake upon wetting. Some pedons are weakly cemented below a depth of 40 inches.

Arroyada Series

The Arroyada series consists of deep, somewhat poorly drained, clayey soils on flood plains of streams. These soils formed in saline, calcareous, clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Arroyada clay, frequently flooded; from the Webb County line marker on Texas Highway 44, 4.3 miles west on Texas Highway 44 to Pintas-Adami Road, 6.8 miles north on Pintas-Adami Road, 1.55 miles west on Withers Road to ranch house, 500 feet west of house on Withers Road, and 100 feet south of road, in rangeland:

Ag1—0 to 12 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine angular blocky structure; very hard, very firm, plastic; common fine roots; 8 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear smooth boundary.

Ag2—12 to 22 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine angular blocky structure; shiny pressure faces on surface of peds; very hard, very firm, plastic; common fine roots; 9 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline; diffuse wavy boundary.

ACgnz—22 to 35 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; few fine distinct brownish mottles; weak fine angular blocky structure; common intersecting slickensides; very hard, very firm, plastic; few fine roots; few threads of salt; 8 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline; diffuse wavy boundary.

Cknz—35 to 60 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; few fine distinct brownish mottles; massive; few slickensides; very hard, very firm, plastic; few fine roots; common concretions of calcium carbonate; common films and threads of salt; 8 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline.

Solum thickness ranges from 24 to 54 inches. Intersecting slickensides begin at a depth of 12 to 30 inches. When this soil is dry, cracks 0.25 to 1.0 inch wide form at the surface and extend to a depth of 20 inches or more. Exchangeable sodium is more than 15 percent below a depth of 20 inches and increases with depth. Electrical conductivity is 0 to 4 mmhos/cm at 25°C in the upper 10 inches and increases with depth. It is 4 to 20 mmhos/cm below a depth of 20 inches. The total clay content in the 10- to 40-inch control section is 45 to 60 percent. Texture is clay or silty clay throughout. The amplitude of waviness in the boundary between the A and AC horizons is about 5 to 17 inches. Reaction is mildly alkaline or moderately alkaline throughout.

The A horizon is gray or dark gray.

The AC horizon is gray, light brownish gray, grayish brown, pale brown, or brown. Mottles are fine or medium, faint or distinct, and brownish or grayish.

The C horizon is light gray, light brownish gray, very pale brown, or pale brown. Mottles are the same as in the AC horizon.

Brundage Series

The Brundage series consists of deep, moderately well drained, loamy soils in upland valleys. These soils formed in saline, loamy alluvium along small drains. Slopes range from 0 to 1 percent.

Typical pedon of Brundage fine sandy loam, occasionally flooded (fig. 22); from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 18.0 miles north on Interstate Highway 35 to junction with U.S. Highway 83, 4.0 miles northwest on U.S.

Highway 83, 10.3 miles northwest on Jefferies Road, and 25 feet north, in rangeland:

- A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; slightly acid; abrupt smooth boundary.
- Btzn1—5 to 9 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium and coarse columnar structure parting to moderate fine and medium angular blocky; thin light brownish gray (10YR 6/2) caps about 1 mm to 5 mm thick on columns; very hard, firm; few fine roots; few very fine pores and root channels; thin patchy clay films on vertical surface peds; saline; mildly alkaline; clear wavy boundary.
- Btzn2—9 to 15 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; very hard, firm; few fine roots; few fine pores and root channels; patchy clay films on surface of peds; saline; mildly alkaline; gradual wavy boundary.
- Btknz—15 to 30 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few threads of calcium carbonate; saline; calcareous; moderately alkaline; gradual wavy boundary.
- Bknz1—30 to 46 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; about 3 percent, by volume, threads, films, and soft masses of calcium carbonate; saline; calcareous; moderately alkaline; gradual wavy boundary.
- Bknz2—46 to 60 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; massive; hard, friable; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; saline; calcareous; moderately alkaline.

Solum thickness ranges from 40 inches to more than 80 inches. Exchangeable sodium is 15 to 40 percent in some parts of the upper 16 inches of the Bt horizon. Electrical conductivity is less than 4 mmhos/cm at 25°C in the A horizon, 4 to 16 mmhos/cm in the upper part of the Bt horizon, and more than 8 mmhos/cm in the lower part of the Bt and the Bk horizon. The depth to secondary calcium carbonate ranges from 6 to 22 inches.



Figure 22.—Profile of Brundage fine sandy loam, occasionally flooded. Note the upper boundary of the natric horizon at a depth of about 5 inches. The scale is in decimeters and in feet.

The A horizon is brown, grayish brown, light brownish gray, pale brown, very pale brown, or dark grayish brown. It is slightly acid to mildly alkaline.

The Bt horizon is dark grayish brown, grayish brown, brown, light brownish gray, light yellowish brown, yellowish brown, or very pale brown. It is sandy clay loam or clay loam. The total clay content in the upper 20 inches is 22 to 35 percent. The Bt horizon is slightly acid to moderately alkaline.

The Bk horizon is light yellowish brown, brownish yellow, yellowish brown, pale brown, or very pale brown. It is sandy clay loam or clay loam. Reaction is mildly alkaline or moderately alkaline.

Brystal Series

The Brystal series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous loamy sediments and interbedded sandstones. Slopes range from 0 to 3 percent.

Typical pedon of Brystal fine sandy loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 18 miles north on Interstate Highway 35 to junction with U.S. Highway 83, 7.2 miles northwest on U.S. Highway 83, and 100 feet east of fence, in rangeland:

- A1—0 to 4 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine roots; common fine pores; neutral; clear smooth boundary.
- A2—4 to 12 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; many fine roots; common fine pores; neutral; clear wavy boundary.
- Bt1—12 to 23 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable; common fine roots; common fine pores; thin patchy clay films on vertical surface of peds and in pores; mildly alkaline; gradual wavy boundary.
- Bt2—23 to 32 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable; common fine roots; common fine pores and old root channels; thin patchy clay films on vertical surface of peds and in pores; calcareous; moderately alkaline; gradual wavy boundary.
- Btk1—32 to 40 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; few fine pores; about 3 percent, by volume, threads, films, and soft masses of calcium carbonate; thin patchy clay films on vertical surface of peds and in pores; 11 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- Btk2—40 to 63 inches; reddish yellow (7.5YR 7/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; hard, friable; about 2 percent, by volume, soft masses and concretions of calcium carbonate; thin patchy clay films on vertical surface of peds; 11 percent calcium carbonate equivalent; calcareous; moderately alkaline.

Solum thickness ranges from 60 to more than 90 inches. The depth to secondary calcium carbonate ranges from about 20 to 35 inches.

The A horizon is brown or reddish brown. It is neutral or mildly alkaline.

The Bt horizon is reddish brown, yellowish red, brown, strong brown, brownish yellow, reddish yellow, light brown, or light yellowish brown. It is fine sandy loam or sandy clay loam and has a total clay content of 18 to 30 percent in the upper 20 inches. The Bt horizon is mildly alkaline or moderately alkaline.

Some pedons have a Cr horizon of weakly to strongly cemented sandstone below a depth of 60 inches.

Catarina Series

The Catarina series consists of deep, moderately well drained, clayey soils on upland plains and valleys. These soils formed in saline, calcareous clays and shaly clays. Slopes range from 0 to 2 percent.

Typical pedon of Catarina clay, 0 to 2 percent slopes; from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 10.9 miles north on Interstate Highway 35 to main entrance of Uniroyal Tire Testing facility, 4 miles southeast to plant material test plot, and 100 feet east of plot, in rangeland:

- Ay1—0 to 3 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate fine and very fine granular and very fine angular subangular blocky structure; very hard, friable; common fine roots; few fine pores; few siliceous pebbles; common films and threads of calcium sulfate; calcareous; mildly alkaline; clear smooth boundary.
- Ay2—3 to 14 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure parting to moderate medium angular blocky; extremely hard, firm; common slickensides; common fine and medium roots; common fine and very fine pores; few siliceous pebbles; few films and threads of calcium sulfate; calcareous; mildly alkaline; gradual wavy boundary.
- Bknyz1—14 to 25 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak coarse subangular blocky structure parting to moderate fine and medium angular blocky; extremely hard, very firm; common intersecting slickensides, mostly in lower part; common fine and very fine roots; common fine and very fine pores; common films, threads, and soft bodies of calcium carbonate, calcium sulfate, and other salts; saline; calcareous; mildly alkaline; diffuse wavy boundary.
- Bknyz2—25 to 35 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak coarse subangular blocky structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few intersecting slickensides; few fine roots; common fine and very fine pores; few siliceous pebbles; common threads, films, and soft bodies of calcium carbonate, calcium sulfate, and other salts; saline; calcareous; mildly alkaline; diffuse wavy boundary.
- Bknyz3—35 to 49 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; common faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure parting to moderate fine and medium angular blocky; extremely hard, very firm; common intersecting slickensides; few fine roots; few fine pores; common films, threads, and soft bodies of calcium carbonate, calcium sulfate, and other salts; saline; calcareous; mildly alkaline; gradual wavy boundary.
- Bknyz4—49 to 73 inches; very pale brown (10YR 7/4) silty clay, light yellowish brown (10YR 6/4) moist; weak angular blocky structure; extremely hard, very firm; common intersecting slickensides; few fine roots; few very fine pores; few films, threads and soft bodies of calcium carbonate, calcium sulfate, and other salts; saline; calcareous; mildly alkaline; gradual wavy boundary.
- Bknyz5—73 to 96 inches; very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; weak angular blocky structure; extremely hard, very firm; content of calcium carbonate and other salts same as horizon above except soft bodies somewhat larger; saline; calcareous; mildly alkaline.

Solum thickness ranges from 40 to more than 80 inches. Intersecting slickensides begin at a depth of 12 to 30 inches. When this soil is dry, cracks 0.25 to 1.0 inch wide form at the surface and extend to a depth of 20 inches or more. In some horizons, exchangeable sodium is more than 15 percent within 30 inches of the soil surface. Electrical conductivity is 1 to 8 mmhos/cm at 25°C in the upper 10 inches. It is 4 to 20 mmhos/cm below a depth of 10 inches and increases with depth in the upper 40 inches. The total clay content in the 10- to 40-inch control section ranges from 40 to

60 percent. Reaction is mildly alkaline or moderately alkaline throughout. The amplitude of waviness in the boundary between the A and B horizons is about 2 to 10 inches.

The A horizon is grayish brown, light brownish gray, brown, pale brown, olive gray, light olive gray, olive, pale olive, yellowish brown, or light yellowish brown.

The B horizon is grayish brown, light brownish gray, pale brown, very pale brown, olive gray, light olive brown, light olive gray, olive, olive yellow, pale olive, pale yellow, or light yellowish brown. It is clay or silty clay.

In some pedons, a C horizon or a Cr horizon occurs at a depth of 40 to 80 inches. These horizons are light yellowish brown, olive yellow, pale yellow, or olive, and are clay or shaly clay.

Comitas Series

The Comitas series consists of deep, well drained, sandy soils on uplands. These soils formed in sandy and loamy sediments that have been reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Comitas fine sand, 0 to 3 percent slopes; from the intersection of Texas Highway 359 and U.S. Highway 83 in Laredo, 15.0 miles east on Texas Highway 359, 2.45 miles south and 3.85 miles generally west on ranch road, 1.6 miles south on ranch road, and 50 feet east of fence, in rangeland:

A1—0 to 12 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; neutral; gradual smooth boundary.

A2—12 to 26 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; neutral; gradual wavy boundary.

A3—26 to 35 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine pores; neutral; clear wavy boundary.

Bt—35 to 50 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, very friable; common fine pores; thin patchy clay films in pores; neutral; gradual wavy boundary.

Btk—50 to 63 inches; light brown (7.5YR 6/4) sandy clay loam, light brown (7.5YR 6/4) moist; common medium and coarse distinct reddish yellow (7.5YR 6/6) mottles; weak fine subangular blocky structure; hard, friable; thin patchy clay films on vertical surface of peds; few soft films of calcium carbonate; mildly alkaline.

Solum thickness is more than 60 inches. Thickness of the sandy surface layer ranges from 20 to 40 inches. Depth to secondary calcium carbonate ranges from 36 to 60 inches. Most pedons have reddish yellow mottles between depths of 50 and 80 inches.

The A horizon is grayish brown, dark grayish brown, or brown. Reaction is slightly acid or neutral.

The B horizon is brown, light brown, pale brown, or reddish yellow. It is fine sandy loam or sandy clay loam and has a total clay content of 10 to 24 percent. Reaction is neutral to mildly alkaline in the upper part of the B horizon and mildly alkaline to moderately alkaline in the lower part.

Copita Series

The Copita series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy sediments or residuum over sandstone and interbedded sandstone. Slopes range from 0 to 3 percent.

Typical pedon of Copita fine sandy loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 83 and Texas Highway 359 in Laredo, 13.3 miles south on U.S. Highway 83, and 50 feet west of fence, in rangeland:

- A—0 to 9 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; many fine and medium roots; common fine and medium pores; 6 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- Bk1—9 to 24 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable; common fine and medium roots; few fine pores; 10 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.
- Bk2—24 to 37 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; about 5 percent, by volume, films, threads, and soft masses of calcium carbonate; 15 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.
- Crk1—37 to 51 inches; pale yellow (2.5Y 7/4) weakly cemented sandstone, light olive brown (2.5Y 5/4) moist; few fine roots in cracks; some sandy clay loam material in cracks and crevices; about 5 percent, by volume, soft masses of calcium carbonate; 19 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt wavy boundary.
- Crk2—51 to 60 inches, pale yellow (2.5Y 7/4) strongly cemented sandstone, light olive brown (2.5Y 5/4) moist; thin coatings of calcium carbonate in upper part; calcareous; moderately alkaline.

The depth to sandstone ranges from 20 to 40 inches. Calcium carbonate equivalent ranges from 1 to 10 percent in the A horizon and from 10 to 35 percent in the B horizon.

The A horizon is brown, light brown, pale brown, light olive brown, light brownish gray, or grayish brown. Most pedons are fine sandy loam, but some pedons are sandy clay loam. Electrical conductivity is less than 4 mmhos/cm at 25°C.

The B horizon is brown, pale brown, light brown, very pale brown, pale yellow, yellowish brown, or light yellowish brown. It is loam, fine sandy loam, or sandy clay loam, and has a total clay content of 18 to 35 percent. Electrical conductivity ranges from 2 to 8 mmhos/cm at 25°C.

The Cr horizon is weakly cemented or strongly cemented calcareous sandstone, or it is weakly to strongly cemented calcareous sandstone interbedded with loamy sediments.

Cuevitas Series

The Cuevitas series consists of very shallow, well drained, loamy soils on uplands. These soils formed in loamy sediments, partly reworked by wind, over thick beds of caliche. Slopes range from 0 to 3 percent.

Typical pedon of Cuevitas fine sandy loam, in an area of Cuevitas-Randado complex, gently undulating; from the intersection of Texas Highway 359 and Farm

Road 2050 in Bruni, 4.55 miles north on Farm Road 2050, and 50 feet west of fence, in rangeland:

- A1—0 to 2 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/2) moist; massive; slightly hard, very friable; few fine roots; neutral; clear smooth boundary.
- A2—2 to 9 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; about 7 percent, by volume, angular caliche fragments; neutral; abrupt wavy boundary.
- Bkm—9 to 16 inches; white (10YR 8/2) strongly cemented, coarsely fractured caliche that has a laminar upper surface layer; clear wavy boundary.
- Bk—16 to 60 inches; white (10YR 8/2) weakly cemented caliche.

The depth to the petrocalcic horizon ranges from 4 to 10 inches. Coarse fragments of siliceous pebbles and indurated caliche make up 0 to 15 percent of the volume.

The A horizon is brown, reddish brown, or yellowish red. Reaction is neutral or mildly alkaline. Total clay content ranges from 7 to 18 percent.

The Bk horizon is white or pinkish white. It is indurated or strongly cemented caliche that is 6 to 12 inches thick over weakly cemented caliche several feet thick.

Delfina Series

The Delfina series consists of deep, moderately well drained, sandy soils on uplands. These soils formed in loamy sediment reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Delfina loamy fine sand, 0 to 3 percent slopes; from the intersection of Welhausen Road and Texas Highway 359 in Oilton, 16.0 miles east on Texas Highway 359 to ranch road near Greenhill Cemetery, 6.3 miles west on ranch road, 2.1 miles south along fenceline to fence corner, 1.0 mile east along fenceline, and 90 feet north of fence, in rangeland:

- A—0 to 17 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; common fine roots in upper part, few fine roots below; few fine pores; neutral; abrupt wavy boundary.
- Bt1—17 to 24 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common medium distinct reddish, brownish, and grayish mottles; strong fine and medium angular blocky structure; very hard, firm; few fine roots oriented mainly along surfaces of peds; common fine pores; medium nearly continuous clay films on surfaces of peds, thin clay films along pores and root channels in interior of peds; thin, nearly continuous, dark grayish brown coatings on surfaces of peds; neutral; gradual wavy boundary.
- Bt2—24 to 33 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common medium distinct reddish, brownish, and grayish mottles; moderate fine and medium angular blocky structure; very hard, friable; few fine roots oriented mainly along surfaces of peds; few fine pores; thin moderately patchy clay films on surface of peds; thin clay films along pores and root channels; thin, patchy, dark grayish brown color coatings on vertical ped surfaces; neutral; gradual wavy boundary.
- Bt3—33 to 40 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common medium faint brownish mottles; moderate medium subangular blocky structure; very hard, friable; few fine roots; few fine pores; thin patchy clay films on vertical surface of peds; thin, patchy, dark grayish brown color coatings on vertical surfaces of peds; neutral; clear wavy boundary.

- Bt4—40 to 44 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common medium faint brownish mottles; weak fine subangular blocky structure; hard, friable; few fine roots; few fine pores; thin patchy clay films on vertical surface of peds; mildly alkaline; clear wavy boundary.
- Btk1—44 to 54 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; thin patchy clay films on vertical surface of peds; about 2 percent, by volume, soft masses of calcium carbonate; 6 percent calcium carbonate equivalent; calcareous; mildly alkaline; clear wavy boundary.
- Btk2—54 to 65 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common fine and medium distinct reddish mottles; weak fine subangular blocky structure; hard, friable; few fine roots; thin patchy clay films on vertical surface of peds; noncalcareous matrix, but has a few films of calcium carbonate; mildly alkaline.

Solum thickness ranges from 60 to 90 inches. Depth to secondary calcium carbonate ranges from 36 to 80 inches.

The A horizon is dark grayish brown, dark brown, grayish brown, or brown. Reaction is neutral or mildly alkaline.

The Bt horizon is brown, yellowish brown, light yellowish brown, strong brown, pale brown, or light brown. Mottles are reddish, brownish, grayish, or yellowish brown. The Bt horizon is sandy clay loam or clay loam and has a total clay content of 25 to 35 percent. Reaction is neutral to moderately alkaline.

The Btk horizon is very pale brown, light brown, reddish yellow, or light yellowish brown. It is sandy clay loam or fine sandy loam.

Delmita Series

The Delmita series consists of moderately deep, well drained, sandy soils on uplands. These soils formed in loamy sediments reworked by wind over thick beds of caliche. Slopes range from 0 to 3 percent.

Typical pedon of Delmita loamy fine sand, in an area of Delmita-Randado complex, gently undulating; from the intersection of Texas Highway 359 and Farm Road 2050 in Bruni, 3.3 miles north on Farm Road 2050, and 50 feet west of fence, in rangeland:

- A—0 to 12 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; common fine roots; neutral; gradual wavy boundary.
- Bt1—12 to 22 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; common fine pores; thin patchy clay films on vertical surface of peds and thin clay films along pores and root channels; neutral; gradual wavy boundary.
- Bt2—22 to 34 inches; red (2.5YR 5/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; very hard, friable; common fine roots; common fine pores; thin patchy clay films on vertical surface of peds and thin clay films along pores and root channels; neutral; abrupt wavy boundary.
- Bkm1—34 to 36 inches; white (10YR 8/2) strongly cemented caliche that has a laminated upper surface layer with a hardness of 3 on Mohs' scale; abrupt wavy boundary.

Bkm2—36 to 60 inches; white (10YR 8/2) weakly cemented caliche that becomes less cemented as depth increases.

The depth to the petrocalcic horizon ranges from 20 to 40 inches.

The A horizon is reddish brown, light reddish brown, yellowish red, or brown. In most pedons, the A horizon is loamy fine sand. In some pedons, it is fine sandy loam.

The Bt horizon is red, yellowish red, reddish brown, or light reddish brown. It has a few reddish or brownish mottles in the lower few inches in some pedons. The Bt horizon is fine sandy loam or sandy clay loam and has a total clay content of 18 to 30 percent.

The Bkm horizon is white or pink indurated or strongly cemented caliche several feet thick that becomes less cemented as depth increases.

Dilley Series

The Dilley series consists of shallow, well drained, loamy soils on uplands. These soils formed in residuum over sandstone and loamy sediments interbedded with sandstone (fig. 23). Slopes range from 0 to 3 percent.

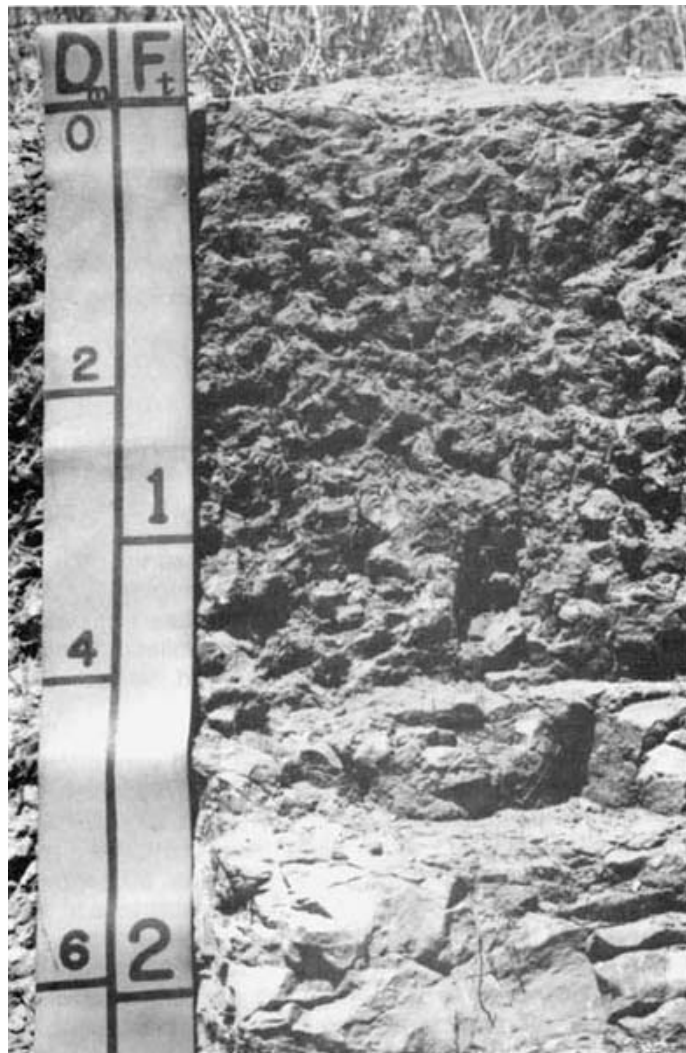


Figure 23.—Profile of Dilley fine sandy loam, 0 to 3 percent slopes. Sandstone is below a depth of 16 inches. The scale is in decimeters and in feet.

Typical pedon of Dilley fine sandy loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 18.0 miles north on Interstate Highway 35 to junction with U.S. Highway 83, 20.0 miles northwest on U.S. Highway 83 to its intersection with Texas Highway 44, 7.8 miles east on Texas Highway 44, 500 feet north of fence, in rangeland:

- A—0 to 8 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common fine pores; neutral; gradual wavy boundary.
- Bt—8 to 13 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak medium prismatic and weak fine subangular blocky structure; hard, friable; common fine roots; many fine pores; clay bridges sand grains; neutral; clear wavy boundary.
- Btk—13 to 16 inches; reddish yellow (7.5YR 6/6) gravelly fine sandy loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; clay bridges sand grains; about 25 percent, by volume, strong brown sandstone fragments with thin coatings of calcium carbonate; few fine concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.
- Crk—16 to 24 inches; strong brown (7.5YR 5/6) weakly cemented, noncalcareous, fractured sandstone; thin coatings of calcium carbonate on the surface of fractures; thin seams of reddish yellow (7.5YR 6/6) fine sandy loam in cracks and crevices; few fine roots in cracks; clear wavy boundary.
- Cr—24 to 60 inches; strong brown (7.5YR 5/6) weakly cemented, noncalcareous, fractured sandstone.

The depth to sandstone ranges from 10 to 20 inches.

The A horizon is reddish yellow, yellowish red, brown, or light brown. Reaction is slightly acid to mildly alkaline.

The Bt horizon is yellowish red, reddish yellow, red, or reddish brown. It is fine sandy loam or sandy clay loam and has a total clay content of 12 to 25 percent. The Bt horizon is slightly acid to moderately alkaline. Sandstone fragments are in the lower part of most pedons at the contact of the bedrock.

The Cr horizon is brownish or reddish weakly cemented sandstone or sandstone interbedded with loamy sediment.

Duval Series

The Duval series consists of deep, well drained, loamy soils on uplands. These soils formed in residuum over sandstone and loamy sediments interbedded with sandstone. Slopes range from 0 to 3 percent.

Typical pedon of Duval fine sandy loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 18.0 miles north on Interstate Highway 35 to junction with U.S. Highway 83, 12.35 miles northwest on U.S. Highway 83, and 60 feet west of fence, in rangeland:

- A—0 to 14 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine and medium roots; common fine pores; neutral; clear smooth boundary.
- Bt1—14 to 22 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; few very fine pores; neutral; gradual wavy boundary.
- Bt2—22 to 32 inches; red (2.5YR 4/6) sandy clay loam; dark red (2.5YR 3/6) moist; weak coarse prismatic structure parting to weak medium

- subangular blocky; hard, friable; few fine roots; few fine pores; thin clay films along pores and root channels; neutral; gradual wavy boundary.
- Bt3—32 to 46 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; common very fine pores; thin clay films along pores and root channels; few ironstone fragments; neutral; clear wavy boundary.
- Bt4—46 to 56 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; very hard, friable; few fine roots; few fine pores; thin clay films along pores and root channels; neutral; abrupt wavy boundary.
- Crk—56 to 62 inches; yellowish red (5YR 5/6) and brownish yellow (10YR 6/6) weakly cemented, noncalcareous sandstone; few fine roots between cracks and crevices in upper part; about 2 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate.

The depth to sandstone ranges from 40 to 60 inches. The depth to secondary calcium carbonate is more than 36 inches.

The A horizon is reddish brown, yellowish red, brown, or light brown. Reaction is slightly acid or neutral.

The Bt horizon is red, reddish brown, yellowish red, or reddish yellow. It is fine sandy loam or sandy clay loam. The clay content in the upper 20 inches of the Bt horizon is 18 to 30 percent. Reaction is slightly acid to mildly alkaline.

The Cr horizon is yellowish, reddish, or brownish weakly cemented sandstone, or it is sandstone interbedded with sandy clay loam or fine sandy loam.

Hebbronville Series

The Hebbronville series consists of deep, well drained, sandy soils on uplands. These soils formed in calcareous, loamy sediments that have been reworked by wind. Slopes range from 0 to 2 percent.

Typical pedon of Hebbronville loamy fine sand, 0 to 2 percent slopes; from the intersection of Texas Highway 359 and Jennings Road in Aguilares, 1.25 miles south on Jennings Road, and 25 feet west of fence, in rangeland:

- A1—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; common fine roots; neutral; clear smooth boundary.
- A2—4 to 19 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; mildly alkaline; gradual wavy boundary.
- Btk1—19 to 34 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; thin patchy clay films on vertical surface of peds; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.
- Btk2—34 to 46 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable; common fine pores; thin patchy clay films on vertical surface of peds; about 2 percent, by volume, threads and films of calcium carbonate; about 3 percent, by volume, siliceous pebbles less than 3 inches in diameter; 6 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- Bk—46 to 60 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; few fine pores;

about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; few siliceous pebbles; 11 percent calcium carbonate equivalent; calcareous; moderately alkaline.

Solum thickness ranges from 60 to 75 inches. Depth to secondary calcium carbonate ranges from 14 to 30 inches.

The A horizon is grayish brown, dark grayish brown, or brown. Reaction is neutral or mildly alkaline.

The upper part of the Bt horizon is brown, yellowish brown, or pale brown. The lower part is light yellowish brown, pale brown, or yellowish brown. The Bt horizon is fine sandy loam or loam; in the upper 20 inches the clay content is 12 to 18 percent. Reaction is neutral to moderately alkaline.

The Bk or C horizon is light yellowish brown, very pale brown, or pale brown. It is sandy clay loam or fine sandy loam.

Jimenez Series

The Jimenez series consists of very shallow to shallow, very gravelly, well drained, loamy soils on uplands. These soils formed in thick beds of gravelly caliche. Slopes range from 1 to 8 percent.

Typical pedon of Jimenez very gravelly sandy clay loam, in an area of Jimenez-Quemado complex, undulating; from the intersection of Interstate Highway 35 and Farm Road 1472 in Laredo, 46.7 miles northwest on Farm Road 1472 and Eagle Pass Road, 50 feet northeast of fence, in rangeland:

A1—0 to 9 inches; dark brown (7.5YR 4/2) very gravelly sandy clay loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; many fine roots; about 70 percent, by volume, waterworn siliceous fragments, 60 percent of which are 0.25 inch to 3.0 inches across and 10 percent are 3 to 5 inches across; pebbles and cobbles have thin coatings of calcium carbonate on the surface; 9 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

A2—9 to 13 inches; brown (7.5YR 5/2) very gravelly sandy clay loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; about 75 percent, by volume, waterworn siliceous pebbles and cobbles, 65 percent of which are 0.25 inch to 3.0 inches across and 10 percent are 3 to 5 inches across; pebbles and cobbles have thin coatings of calcium carbonate on the surface; 21 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt wavy boundary.

Bkm—13 to 25 inches; pinkish white (7.5YR 8/2) and pink (7.5YR 8/4) strongly cemented caliche that is laminar in the upper 1 inch; about 45 percent, by volume, embedded gravel; clear wavy boundary.

Bk/C—25 to 60 inches; pink (7.5YR 8/4) weakly cemented caliche; about 70 percent, by volume, waterworn siliceous gravel.

The depth to the petrocalcic horizon ranges from 7 to 18 inches. Content of coarse fragments ranges from 50 to 80 percent. The calcium carbonate equivalent is 1 to 40 percent. Reaction is moderately alkaline throughout. The surface cover of gravel ranges from 30 to 90 percent.

The A horizon is dark brown, brown, grayish brown, or dark grayish brown. In most pedons, the fine-earth fraction is sandy clay loam, but in some pedons it is sandy loam.

The Bkm horizon is strongly cemented or indurated, gravelly or very gravelly caliche that becomes less cemented as depth increases. In some pedons, the Bkm horizon is fractured and platy in the upper part.

The Bk/C horizon is weakly cemented gravelly or very gravelly caliche that becomes less cemented as depth increases.

Lagloria Series

The Lagloria series consists of deep, well drained, loamy soils on old stream terraces. These soils formed in calcareous, loamy alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Lagloria silt loam, 0 to 1 percent slopes; from the intersection of Del Mar Boulevard and Santa Maria Avenue in Laredo, 0.3 mile south on Santa Maria Avenue, 0.25 mile west on farm road, 50 feet south, in cultivated field:

- Ap—0 to 7 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable; some worm holes; 16 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear smooth boundary.
- A—7 to 19 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard; friable; many fine pores; some small worm holes; 19 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.
- Bw—19 to 42 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, friable; many fine pores; few mica flakes; faint stratification below 36 inches; few threads and films of calcium carbonate in lower part; 17 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- C—42 to 63 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; many fine pores; faint stratification; 17 percent calcium carbonate equivalent; calcareous; moderately alkaline.

Depth to stratification ranges from 36 to 50 inches. Reaction is moderately alkaline throughout the profile.

The A horizon is grayish brown, light brownish gray, pale brown, brown, or very pale brown.

The B horizon is pale brown, light brownish gray, light yellowish brown, or very pale brown. It is silt loam, loam, or very fine sandy loam and has a clay content of 8 to 18 percent.

The C horizon is light yellowish brown, light brownish gray, or very pale brown. It is silt loam, loam, or very fine sandy loam. Individual strata are clayey, loamy, or sandy.

Laredo Series

The Laredo series consists of deep, well drained, loamy soils on old stream terraces. These soils formed in calcareous, loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Laredo silty clay loam, rarely flooded; from the intersection of Interstate Highway 35 and Farm Road 1472 in Laredo, 10.95 miles northwest on Farm Road 1472, and 50 feet south of fence, in cultivated field:

- Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; very hard, firm; calcareous; moderately alkaline; clear smooth boundary.
- A—8 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky

structure; very hard, firm; common fine pores; calcareous; moderately alkaline; clear smooth boundary.

Bw1—18 to 38 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable; common fine pores; some gravel in lower part; calcareous; moderately alkaline; gradual wavy boundary.

Bw2—38 to 50 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; faintly stratified in lower part; calcareous; moderately alkaline; gradual wavy boundary.

Ck—50 to 60 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable; about 1 percent, by volume, soft masses and concretions of calcium carbonate; faintly stratified; calcareous; moderately alkaline.

Depth to stratification is 40 to about 50 inches. Reaction is moderately alkaline throughout.

The A horizon is dark grayish brown or brown.

The B horizon is brown, grayish brown, or pale brown. The total clay content ranges from 20 to 40 percent. The content of carbonate clay ranges from a trace to about 10 percent.

The Ck horizon is very pale brown or light brownish gray. It is silt loam or silty clay loam. Soft masses and concretions of calcium carbonate make up 1 percent to about 5 percent of the volume of the Ck horizon.

Maverick Series

The Maverick series consists of moderately deep, well drained, clayey soils on uplands. These soils formed in saline, calcareous, shaly clay and shale. Slopes range from 3 to 10 percent.

Typical pedon of Maverick clay, in an area of Maverick-Catarina complex, gently rolling; from the intersection of Farm Road 1472 and Interstate Highway 35 in Laredo, 24.7 miles northwest on Farm Road 1472, and 1,100 feet south of fence, in rangeland:

A—0 to 6 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium subangular blocky structure parting to weak fine angular blocky; very hard, firm, sticky, plastic; common fine and medium roots; few fine siliceous pebbles; few fine pores; 7 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bz—6 to 15 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; weak fine and medium angular blocky structure; very hard, firm; few fine reddish brown mottles; few fine roots; few fine siliceous pebbles; few shiny pressure faces on surface of peds; 6 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline; clear wavy boundary.

Byz—15 to 25 inches; pale olive (5Y 6/3) clay, olive (5Y 4/3) moist; weak fine and medium angular blocky structure; very hard, firm; few fine roots; about 10 percent, by volume, crystals of calcium sulfate; 5 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline; gradual wavy boundary.

Crz—25 to 60 inches; pale yellow (5Y 7/3) shaly clay, olive (5Y 5/3) moist; massive; very hard; firm; 23 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline.

The depth to shaly clay or shale ranges from 20 to 40 inches. Electrical conductivity is less than 4 mmhos/cm at 25°C in the surface layer and increases as depth increases. Electrical conductivity is 4 to 12 mmhos/cm in the B horizon and 8 to 16 mmhos/cm in the C horizon.

The A horizon is light yellowish brown, grayish brown, olive gray, light olive gray, or pale olive. In some pedons, the A horizon contains up to 50 percent, by volume, siliceous gravel.

The B horizon is pale yellow, pale olive, very pale brown, or light yellowish brown. It is clay or clay loam and has a total clay content of 35 to 55 percent.

The Cr horizon is olive or pale yellow. It is shaly clay or shale. The shaly clay or shale is interbedded with sandstone in some pedons.

Moglia Series

The Moglia series consists of deep, well drained, loamy soils on uplands. These soils formed in saline, calcareous, stratified loamy sediments. Slopes range from 1 to 5 percent.

Typical pedon of Moglia clay loam, 1 to 5 percent slopes; from the intersection of U.S. Highway 59 and Interstate Highway 35 in Laredo, 22.05 miles east on U.S. Highway 59 and 50 feet south of fence, in rangeland:

- A—0 to 7 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; hard, firm; many fine and medium roots; few fine pores; 6 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.
- Bkz—7 to 21 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate medium angular blocky structure; very hard, firm; common fine roots in upper part, few fine roots below; few fine pores; few films and threads of calcium carbonate; few siliceous pebbles; 15 percent calcium carbonate equivalent; saline; calcareous; mildly alkaline; clear wavy boundary.
- Bknz—21 to 30 inches; very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; common films of calcium carbonate; 16 percent calcium carbonate equivalent; saline; calcareous; mildly alkaline; clear wavy boundary.
- 2Cknz—30 to 42 inches; pink (7.5YR 7/4) loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; soft, very friable; few fine roots in upper part; common films of calcium carbonate; 15 percent calcium carbonate equivalent; saline; calcareous; mildly alkaline; clear wavy boundary.
- 2Cknyz—42 to 54 inches; pink (7.5YR 8/4) loam, pink (7.5YR 7/4) moist; weak fine subangular blocky structure; slightly hard, very friable; about 3 percent, by volume, films, threads, and soft masses of calcium carbonate; about 8 percent, by volume, soft masses and crystals of calcium sulfate; 8 percent calcium carbonate equivalent; saline; calcareous; mildly alkaline; clear wavy boundary.
- 3Cknyz—54 to 60 inches; pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; very hard, firm; about 3 percent, by volume, threads, films, and soft masses of calcium carbonate; about 15 percent, by volume, threads, films, soft masses, and crystals of calcium sulfate and other salts; 7 percent calcium carbonate equivalent; saline; calcareous; mildly alkaline.

Solum thickness ranges from 20 to 40 inches. Depth to a lithologic discontinuity is 15 to 38 inches. Total clay in the 10- to 40-inch control section ranges from 25 to 42

percent, and silicate clay content ranges from 20 to 35 percent. Calcium carbonate equivalent in the 10- to 40-inch control section averages 10 to 20 percent.

The depth to the calcic horizon is 5 to 39 inches, and the calcic horizon has a calcium carbonate equivalent of 5 to 15 percent more than that of the C horizon. Visible crystals of gypsum and other salts range from 0 to 25 percent, by volume, and occur below a depth of 40 inches. Siliceous pebbles make up 0 to about 10 percent of the volume and commonly are concentrated in the upper part of the pedon. Electrical conductivity is 0 to 2 mmhos/cm at 25°C in the surface layer and ranges from 4 to more than 16 mmhos/cm in some horizons within 25 inches of the soil surface. Electrical conductivity decreases with depth in most pedons but is greater than 8 mmhos/cm in all horizons below a depth of 25 inches. Exchangeable sodium ranges from 15 percent to more than 30 percent in some horizons within 25 inches of the soil surface, and it is more than 15 percent in horizons below a depth of 25 inches. Reaction is mildly alkaline or moderately alkaline throughout.

The A horizon is brown, grayish brown, brownish gray, light yellowish brown, or light brownish gray.

The Bk horizon is brown, pale brown, very pale brown, light yellowish brown, light brownish gray, or light brown. It is clay loam or clay.

The 2C and 3C horizons are light brownish gray, very pale brown, light brown, pink, pale brown, light brownish gray, or very pale brown. The 2C horizon is loam or clay, loam. The 2C horizon is absent in some pedons. The 3C horizon is clay loam, clay or shaly clay. Shaly clay occurs below a depth of 40 inches.

Montell Series

The Montell series consists of deep, moderately well drained, saline, clayey soils on upland plains and valleys. These soils formed in saline, calcareous clays. Slopes range from 0 to 2 percent.

Typical pedon of Montell clay, saline, 0 to 2 percent slopes; from the intersection of Interstate Highway 35 and U.S. Highway 59 in Laredo, 36.6 miles east on U.S. Highway 59, 1.0 mile south on Welhausen Road, and 50 feet west, in rangeland:

- A—0 to 12 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium angular blocky and moderate fine subangular blocky structure; very hard, very firm; very sticky, very plastic; many fine roots; few snail shells; 10 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- Anz—12 to 28 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium angular blocky structure; wedge-shaped peds with the long axes tilted more than 10 degrees from horizontal; distinct slickensides in the lower part; very hard, very firm, very sticky, very plastic; common fine roots; 11 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline; gradual wavy boundary.
- ACnz—28 to 38 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak medium angular blocky structure; wedge-shaped peds with the long axes tilted more than 10 degrees from horizontal; very hard, very firm, very sticky, very plastic; few fine roots; few threads and films of calcium carbonate; broken peds have streaks of gray clay; 12 percent calcium carbonate equivalent; moderately alkaline; gradual wavy boundary.
- Cnz—38 to 60 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; massive; very hard, very firm, very sticky, very plastic; few fine roots in upper part; common threads and films of calcium carbonate; 7 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline.

The solum ranges from 36 to 54 inches in thickness. Intersecting slickensides begin at a depth of 20 to 30 inches. Montell soils, when dry, have cracks 0.25 inch to 1.0 inch wide that form at the surface and extend to a depth of 20 inches or more. The exchangeable sodium is more than 15 percent at some point within a depth of 30 inches. Electrical conductivity is 1 to 8 mmhos/cm at 25°C in the upper 10 inches and increases as depth increases. Electrical conductivity is 4 to more than 16 mmhos/cm below a depth of 10 inches. Reaction is moderately alkaline throughout. The amplitude of waviness in the boundary between the A and AC horizons is about 4 to 17 inches.

The A horizon is gray or dark gray. When the soil is moist and the value is less than 3.5, the A horizon is less than 12 inches thick.

The AC horizon is grayish brown, light brownish gray, pale brown, brown, or light yellowish brown. It is clay or silty clay and has a clay content of 40 to 60 percent.

The C horizon is similar in color and texture to the AC horizon, but in some pedons it has more crystalline salts. In some pedons, the C horizon has reddish, brownish, or grayish mottles.

Nido Series

The Nido series consists of very shallow, well drained, loamy soils on uplands. These soils formed in calcareous residuum over sandstone and in loamy sediment interbedded with sandstone. Slopes range from 3 to 20 percent.

Typical pedon of Nido fine sandy loam, in an area of Nido-Rock outcrop complex, hilly; from the intersection of Interstate Highway 35 and Farm Road 1472 in Laredo, 8 miles northwest on Farm Road 1472, and 100 feet south of fence, in rangeland:

A—0 to 7 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; about 10 percent, by volume, waterworn siliceous gravel; 5 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt wavy boundary.

Crk—7 to 60 inches; brownish yellow (10YR 6/6) weakly cemented sandstone; thin coatings of calcium carbonate along cracks and fissures in the upper part; few roots in upper part; fine sandy loam material in cracks in upper part.

The depth to sandstone ranges from 3 to 10 inches.

The A horizon is brown, light brown, yellowish brown, grayish brown, or light olive brown. Fragments of gravel or sandstone make up 0 to 15 percent of the volume of the A horizon. The clay content ranges from 11 to 25 percent. The texture is fine sandy loam or sandy clay loam.

The Cr horizon is weakly or strongly cemented, calcareous or noncalcareous sandstone that is interbedded with fine sandy loam or sandy clay loam. Where the sandstone is noncalcareous, cracks and fissures in the upper part are coated with secondary calcium carbonate.

Nido Variant

The Nido Variant consists of very shallow, well drained, loamy soils on uplands. These soils formed in loamy residuum over tuffaceous sandstone. Slopes range from 1 to 5 percent.

Typical pedon of Nido Variant loam, in an area of Nido Variant-Rock outcrop complex, gently undulating; from the intersection of Texas Highway 359 and U.S. Highway 83 in Laredo, 26.0 miles east on Texas Highway 359 to Farm Road 2895, 6.5 miles north on Farm Road 2895, and 50 feet east, in rangeland:

A—0 to 7 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; many fine pores; about 10 percent, by volume, siliceous gravel

and fragments of tuffaceous sandstone; noncalcareous; mildly alkaline; clear wavy boundary.

R—7 to 60 inches; white (10YR 8/1) noncalcareous, strongly cemented, tuffaceous sandstone; thin layers of interbedded clay in the lower part.

The depth to sandstone ranges from 5 to 10 inches. Coarse fragments make up 0 to about 15 percent of the volume.

The A horizon is pale brown, brown, grayish brown, light brownish gray, or dark grayish brown loam, sandy clay loam, or fine sandy loam. The A horizon is mildly alkaline or moderately alkaline.

The R horizon is white or light gray, strongly cemented, tuffaceous sandstone and interbedded clay.

Nueces Series

The Nueces series consists of deep, moderately well drained, sandy soils on uplands. These soils formed in loamy sediment overlain by eolian sands. Slopes range from 0 to 3 percent.

Typical pedon of Nueces fine sand, 0 to 3 percent slopes; from the intersection of Texas Highway 359 and Welhausen Road in Oilton, 3.4 miles east on Texas Highway 359, and 50 feet south of fence, in rangeland:

A1—0 to 16 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; soft, very friable; common fine roots; neutral; diffuse smooth boundary.

A2—16 to 26 inches; brown (7.5YR 5/4) fine sand, dark brown (7.5YR 4/4) moist; single grained; soft, very friable; neutral; abrupt wavy boundary.

Bt—26 to 40 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; common medium distinct yellowish, reddish, and grayish brown mottles; moderate medium prismatic structure; very hard, very firm; thin nearly continuous clay films on surface of peds; thin patchy color coatings on surface of peds; neutral; diffuse irregular boundary.

Btk—40 to 51 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 5/3) moist; few fine distinct reddish and yellowish mottles; moderate medium prismatic structure; very hard, firm; thin patchy clay films on vertical surface of peds; few threads and films of calcium carbonate; mildly alkaline; gradual irregular boundary.

Bk—51 to 63 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; many medium prominent reddish yellow mottles; weak coarse angular blocky structure; very hard; friable; thin patchy clay films on vertical surface of peds; few soft masses of calcium carbonate; mildly alkaline.

The thickness of the solum ranges from 60 to about 100 inches. The thickness of the sandy surface layer ranges from 20 to 40 inches. Reaction is slightly acid or neutral in the upper part of the solum and neutral to moderately alkaline in the lower part.

The A horizon is grayish brown, brown, light brownish gray, pale brown, light brown, or light yellowish brown.

The Bt horizon is brown, grayish brown, light gray, yellowish brown, light brownish gray, yellowish brown, or reddish yellow. It is sandy clay loam or fine sandy loam; the clay content is 18 to 35 percent.

Palafox Series

The Palafox series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy sediment. Slopes range from 0 to 3 percent.

Typical pedon of Palafox clay loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 35 and Farm Road 1472 in Laredo, 27.9 miles northwest on Farm Road 1472, and 50 feet east of fence, in rangeland:

- A—0 to 12 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky and weak fine granular structure; hard, firm; common fine roots; many fine and very fine pores; few small waterworn siliceous pebbles; few peds at 4 to 5 inches are noncalcareous; 6 percent calcium carbonate equivalent; calcareous matrix; moderately alkaline; gradual wavy boundary.
- Bk1—12 to 28 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, firm; common fine roots; many fine pores; few small waterworn siliceous pebbles; few threads and films of calcium carbonate; 17 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- Bk2—28 to 34 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium angular blocky structure; very hard, firm; few fine roots; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; 22 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.
- Bkz—34 to 45 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine angular blocky structure; very hard, firm; few fine roots in upper part; few films and soft masses of calcium carbonate; 19 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline; gradual wavy boundary.
- Ckyz—45 to 72 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; massive; hard, firm; about 10 percent, by volume, threads, films, soft masses, and crystals of gypsum; few threads and films of calcium carbonate; 12 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline.

The solum is 30 to 60 inches thick. The content of clay in the 10- to 40-inch control section ranges from 25 to 40 percent, and that of silicate clay ranges from 20 to 35 percent. The calcium carbonate equivalent in the 10-to 40-inch control section ranges from 10 to 25 percent.

The calcic horizon is at a depth of 10 to 39 inches and has a calcium carbonate equivalent that is 5 to 15 percent more than that of the C horizon. Coarse fragments of siliceous gravel make up 0 to about 10 percent of the volume and may be concentrated in a single horizon. Electrical conductivity is 0 to 2 mmhos/cm at 25°C in the upper 30 inches and ranges from 2 to 16 mmhos/cm below a depth of 30 inches. Exchangeable sodium is 0 to 10 percent in the upper 30 inches and increases as depth increases. Reaction is moderately alkaline or strongly alkaline throughout.

The A horizon is brown, grayish brown, pale brown, or light brownish gray.

The B horizon is brown, light yellowish brown, pale brown, yellowish brown, or very pale brown. It is clay loam or silty clay loam.

The C horizon is light yellowish brown, pale brown, very pale brown, pink, or pale yellow. It is clay loam, silty clay loam, or loam. Crystalline gypsum and other salts in the C horizon range from 1 to 15 percent, by volume.

Quemado Series

The Quemado series consists of shallow, very gravelly, well drained loamy soils on uplands. These soils formed in thick beds of gravelly caliche (fig. 24). Slopes range from 1 to 5 percent.



Figure 24.—Profile of Quemado very gravelly sandy loam. The upper boundary of the petrocalcic horizon is at a depth of 12 to 15 inches. The cemented caliche and gravel are important as road construction material. The scale is in decimeters and in feet.

Typical pedon of Quemado very gravelly sandy loam, in an area of Jimenez-Quemado complex, undulating; from the intersection of Interstate Highway 35 and Farm Road 1472 in Laredo, 45.5 miles northwest on Farm Road 1472 and Eagle Pass Road, 100 feet south of fence, in rangeland:

- A—0 to 6 inches; reddish brown (5YR 5/4) very gravelly sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard; friable; common fine roots; many fine and medium pores; about 50 percent, by volume, waterworn siliceous gravel 0.25 inch to 3.0 inches across; neutral; gradual wavy boundary.

Bt—6 to 12 inches; reddish brown (5YR 4/4) very gravelly sandy clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; common fine roots; many fine pores; about 60 percent, by volume, waterworn siliceous gravel 0.25 inch to 3.0 inches across; neutral; abrupt wavy boundary.

Bkm—12 to 14 inches; white (10YR 8/2) strongly cemented caliche; about 30 percent, by volume, embedded gravel; abrupt wavy boundary.

Bk—14 to 60 inches; white (10YR 8/3) weakly cemented caliche; 40 percent, by volume, embedded gravel.

The depth to the petrocalcic horizon ranges from 10 to 20 inches. Coarse fragments in the solum make up 35 to 80 percent, by volume. The pebbles are siliceous, and most are less than 2 inches in diameter. About 30 to 90 percent of the surface is covered by gravel.

The A horizon is brown, dark brown, or reddish brown. It is neutral or mildly alkaline.

The Bt horizon is brown or reddish brown very gravelly loam, very gravelly sandy loam, or very gravelly sandy clay loam. The content of clay in the fine earth fraction ranges from 15 to 26 percent. Reaction is neutral or mildly alkaline.

The Bkm horizon is strongly cemented or indurated gravelly or very gravelly caliche that becomes less cemented with depth. In some pedons, the horizon has a laminar cap that has a hardness of more than 3 on the Mohs' scale.

The Bk horizon is weakly cemented gravelly or very gravelly caliche that becomes less cemented as depth increases.

Randado Series

The Randado series consists of shallow, well drained, sandy and loamy soils on uplands. These soils formed in loamy sediment partly reworked by wind over thick beds of caliche. Slopes range from 0 to 3 percent.

Typical pedon of Randado fine sandy loam, in an area of Cuevitas-Randado complex, gently undulating; from the intersection of Texas Highway 359 and Welhausen Road in Oilton, 3.9 miles north on Welhausen Road, and 100 feet east, in rangeland:

A1—0 to 3 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, very friable; many fine roots; many fine pores; few angular caliche fragments; neutral; gradual wavy boundary.

A2—3 to 10 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; weak fine subangular blocky structure; hard, friable; many fine roots; neutral; gradual wavy boundary.

Bt—10 to 16 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores; thin patchy clay films on vertical surface of peds; neutral; abrupt wavy boundary.

Bkm—16 to 22 inches; white (10YR 8/2) strongly cemented, coarsely fractured caliche; gradual wavy boundary.

Bk—22 to 60 inches; white (10YR 8/2) weakly cemented caliche.

The depth to the petrocalcic horizon ranges from 10 to 20 inches. Reaction is neutral or mildly alkaline above the petrocalcic horizon.

The A horizon is red, reddish brown, yellowish red, or strong brown. It is fine sandy loam or loamy fine sand.

The Bt horizon is red, reddish brown, yellowish red, or strong brown. It is fine sandy loam or sandy clay loam and has a total clay content of 15 to 27 percent.

The Bkm horizon is white or pinkish white, strongly cemented or indurated caliche that becomes less cemented as depth increases.

The Bk horizon is weakly cemented caliche that becomes less cemented as depth increases.

Rio Grande Series

The Rio Grande series consists of deep, well drained, loamy soils on bottom lands. These soils formed in calcareous, recent loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Rio Grande very fine sandy loam, occasionally flooded; from the intersection of Texas Highway 359 and U.S. Highway 83 in Laredo, 4 miles south on U.S. Highway 83, 1 mile west on farm road, and 100 feet north, in rangeland:

Ap—0 to 6 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable; common fine roots; 13 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt smooth boundary.

C1—6 to 25 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; few fine roots; common bedding planes; few thin layers of silty clay loam; 17 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

C2—25 to 63 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; some bedding planes; thin strata of silty clay loam; 19 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The thickness of the soil ranges from 60 inches to more than 100 inches. The calcium carbonate equivalent in the 10- to 40-inch control section ranges from 5 to 20 percent. Reaction is moderately alkaline throughout.

The A and C horizons are pale brown, light brownish gray, or very pale brown.

The C horizon contains few to many evident strata that range in texture from loamy very fine sand through silty clay loam. It is stratified very fine sandy loam, loam, or silt loam, and has a total clay content of 4 to 20 percent.

Tela Series

The Tela series consists of deep, well drained, loamy soils in narrow upland valleys. These soils formed in calcareous loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Tela sandy clay loam, frequently flooded; from the intersection of Texas Highway 359 and Farm Road 2050 in Bruni, 5.2 miles north on Farm Road 2050, and 50 feet east of fence, in rangeland:

A—0 to 14 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; mildly alkaline; gradual wavy boundary.

Bt1—14 to 19 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; hard; firm; few fine roots; thin patchy clay films on vertical surface of peds; mildly alkaline; gradual irregular boundary.

Bt2—19 to 40 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; hard, firm; few fine roots; thin patchy clay films on vertical surface of peds; calcareous; moderately alkaline; gradual wavy boundary.

BCK—40 to 45 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; hard, friable; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Ck—45 to 63 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; hard, friable; about 15 percent, by volume, soft masses and concretions of calcium carbonate; 37 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The solum is 28 to 50 inches thick. The depth to secondary carbonates ranges from 12 to 34 inches. Reaction is neutral or mildly alkaline in the upper part of the solum and mildly alkaline or moderately alkaline in the lower part.

The A horizon is brown, dark grayish brown, very dark grayish brown, grayish brown, or dark brown.

The Bt horizon is brown, dark brown, dark grayish brown, pale brown, brown, grayish brown, or light brownish gray. It is sandy clay loam or clay loam. The total clay content in the upper 20 inches of the Bt horizon is 18 to 35 percent.

The BC and C horizons are pale brown, light brownish gray, or very pale brown clay loam, sandy clay loam, or loam.

Verick Series

The Verick series consists of shallow, well drained, loamy soils on uplands. These soils formed in calcareous loamy residuum over sandstone. Slopes range from 1 to 5 percent.

Typical pedon of Verick fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 359 and U.S. Highway 83 in Laredo, 2.5 miles south on U.S. Highway 83, 0.5 mile east on ranch road, and 50 feet south of fence, in rangeland:

A—0 to 9 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; 6 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bt—9 to 15 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few soft sandstone fragments in lower part; 11 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt wavy boundary.

Crk—15 to 20 inches; light yellowish brown (2.5YR 6/4) weakly cemented noncalcareous sandstone; thin coatings of calcium carbonate on the surface and in cracks and crevices; gradual wavy boundary.

Cr—20 to 60 inches; light yellowish brown (2.5YR 6/4) weakly cemented, noncalcareous sandstone.

The depth to sandstone ranges from 10 to 20 inches. Reaction is moderately alkaline throughout.

The A horizon is grayish brown, brown, yellowish brown, pale brown, or light yellowish brown.

The B horizon is pale brown, light yellowish brown, grayish brown, or yellowish brown. It is fine sandy loam, loam, or sandy clay loam and has a clay content of 15 to 25 percent.

The Cr horizon is noncalcareous or calcareous sandstone.

Viboras Series

The Viboras series consists of moderately deep, moderately well drained, clayey soils on uplands. These soils formed in saline, calcareous, clayey residuum over siltstone and shaly clay. Slopes range from 0 to 3 percent.

Typical pedon of Viboras clay, 0 to 3 percent slopes; from the intersection of U.S. Highway 59 and Interstate Highway 35 in Laredo, 32.0 miles north on Interstate Highway 35 to junction of Callaghan road and access road on the east side of Interstate Highway 35, 12.6 miles east on Callaghan road to a windmill next to a gas plant, 0.45 mile east of windmill on Callaghan Road, 50 feet south of road, in rangeland:

- A—0 to 3 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium angular blocky structure; very hard, very firm; many fine roots; few fine pores; 0.5 inch mulch of brown granular clay loam at the surface; few waterworn pebbles on the surface; noncalcareous matrix, but parts of some peds are calcareous; moderately alkaline; clear smooth boundary.
- Bn—3 to 9 inches; reddish brown (5YR 5/3) clay; reddish brown (5YR 4/3) moist; moderate coarse angular blocky structure; very hard, very firm; common fine roots; few fine pores; few waterworn pebbles and fragments of snail shells; few streaks of dark brown material from the A horizon; shiny pressure faces on surface of peds; 10 percent calcium carbonate equivalent; 3 mmhos/cm conductivity at 25°C; 18 percent exchangeable sodium; moderately alkaline; clear wavy boundary.
- Bnz—9 to 16 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate coarse angular blocky structure; very hard; very firm; few fine roots; few waterworn pebbles and snail shells; shiny pressure faces on surface of peds; 10 percent calcium carbonate equivalent; 8.5 mmhos/cm conductivity at 25°C; 20 percent exchangeable sodium; saline; calcareous; moderately alkaline; clear wavy boundary.
- Bknyz—16 to 28 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; very hard; very firm; few fine roots; about 2 percent, by volume, threads and films of calcium carbonate; few threads, films, and crystals of calcium sulfate and other salts; few siltstone fragments in lower part; 10 percent calcium carbonate equivalent; 11 mmhos/cm conductivity at 20°C; 25 percent exchangeable sodium; saline; calcareous; moderately alkaline; clear wavy boundary.
- Cknyz—28 to 36 inches; reddish brown (5YR 5/4) and light gray (10YR 7/1) fractured siltstone with reddish brown (5YR 5/4) clay in cracks and crevices; siltstone fragments are partly weathered and easily broken by hand when dry, and slake in water; few fine roots between cracks; few threads, films, and concretions of calcium carbonate; few threads and crystals of calcium sulfate and other salts; 17 percent calcium carbonate equivalent; 11 mmhos/cm conductivity at 25°C; 25 percent exchangeable sodium; saline; calcareous; moderately alkaline; gradual wavy boundary.
- Crnz—36 to 60 inches; reddish brown (5YR 5/4) and light gray (10YR 7/1) fractured siltstone and clayey shale that can be broken with some difficulty by hand and is easily penetrated with a hand auger when dry, but slakes in water; 22 percent calcium carbonate equivalent; saline; calcareous; moderately alkaline.

The solum ranges in thickness from 20 to 40 inches. Electrical conductivity is 1 to 8 mmhos/cm at 25°C in the A horizon and 4 to 35 mmhos/cm in the B and C horizons. Exchangeable sodium is more than 15 percent at some point in the upper

20 inches of the solum and increases with depth. The calcium carbonate equivalent in the control section ranges from 5 to 25 percent. The content of visible calcium carbonate ranges from 0 to 5 percent, by volume, in the B horizon. Crystalline calcium sulfate and other salts make up 0 to 5 percent, by volume, of the B horizon. When this soil is dry, cracks 0.25 to 1.0 inch wide form at the surface and extend to a depth of 20 inches or more. Reaction is mildly alkaline or moderately alkaline in the upper part of the solum and is moderately alkaline in the lower part.

The A horizon is dark brown, reddish brown, reddish gray, or brown.

The B horizon is reddish brown, brown, light reddish brown, pinkish gray, or reddish gray. Total clay content ranges from 40 to 60 percent.

The C horizon is siltstone or stratified siltstone and shale. In some pedons, the C horizon has strata of sandstone.

Zapata Series

The Zapata series consists of very shallow, well drained, loamy soils on uplands. These soils formed in calcareous loamy sediment over thick beds of caliche. Slopes range from 1 to 5 percent.

Typical pedon of Zapata gravelly sandy loam, in an area of Zapata-Rock outcrop complex, gently undulating; from the intersection of U.S. Highway 59, Interstate Highway 35, and U.S. Highway 83 in Laredo, 39.0 miles northwest on U.S. 83, 1.75 miles west on Las Mesas Road, and 100 feet south, in rangeland:

A—0 to 7 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; about 20 percent, by volume, angular and rounded caliche fragments, 10 percent of which are 2 mm to 20 mm across and 10 percent are 20 mm to 75 mm across; 13 percent calcium carbonate equivalent in fine earth fraction; about 30 percent calcium carbonate equivalent if the percent by weight of particles to 20 mm in size is added; calcareous; moderately alkaline; abrupt wavy boundary.

Bkm—7 to 10 inches; white (10YR 8/2) indurated coarsely fractured caliche with a 1-inch laminar cap that has a hardness of more than 3 on Mohs' scale; abrupt wavy boundary.

Bk—10 to 60 inches; very pale brown (10YR 8/3) caliche that is strongly cemented in the upper part and becomes weakly cemented with depth; massive, with fractures and solution channels.

The depth to the petrocalcic horizon ranges from 2 to 10 inches. The content of caliche fragments ranges from 15 to 25 percent, by volume. About 5 to 20 percent of the surface is covered by gravel.

The A horizon is pale brown, light brownish gray, grayish brown, or brown. Calcium carbonate equivalent is 5 to 40 percent.

The Bkm horizon is indurated or strongly cemented caliche that becomes less cemented as depth increases.

The Bk horizon is strongly cemented caliche that becomes less cemented as depth increases.

Formation of the Soil

In this section the factors of soil formation are discussed and related to the soils in Webb County. In addition, the processes of soil formation are described.

Factors of Soil Formation

Soil is formed by the action and interaction of the five major soil forming factors—climate, living organisms, relief, time, and parent material. The kind of soil that

develops in a given area is determined by these factors, although the effect of any one factor is sometimes difficult to isolate. Parent material as a factor of formation is discussed in this section and also in the last section, "Surface Geology and Parent Material".

Climate

Rainfall, temperature, and wind have been important in the formation of soils in Webb County. Summers in the county are hot, and winters are mild. The annual rainfall ranges from 18 inches in the western part of the county to about 22 inches in the eastern part.

High temperatures and low rainfall have limited the accumulation of organic matter in the soils. In addition, the low rainfall in most years is not sufficient to leach calcium carbonate or soluble salts below the rooting zone in most of the soils. As a result, most of the soils have horizons in which soluble salts or calcium carbonate have accumulated. Many of the soils are calcareous throughout.

Wind has also affected the formation of soils in the county. The sand sheet in southeastern Webb County consists of eolian sediments that overlie older alluvial sediments.

Living Organisms

Plants, animals, earthworms, insects, and micro-organisms are important in the formation of soils. Living organisms are largely responsible for the amount of organic matter and nitrogen in the soil, for gains or losses in plant nutrients, and for changes in soil structure and porosity.

Vegetation, mostly grasses and brush, has had a major effect on soil formation in Webb County. Decayed roots contribute organic matter to the soils and leave channels and pores that provide passageways for the intake of air and water. Deep rooting brush plants bring nutrients from lower layers in the soil to the surface.

Earthworms, insects, and burrowing animals have mixed soil materials and have helped the downward movement of air, water, and plant roots into the soil. Bacteria and fungi break down organic matter, improving the fertility and tilth of the soils.

The influence of man has considerably affected the soils in Webb County. In the past, ranchers overstocked many areas of the rangeland. The resultant overgrazing caused the better grasses to decrease and the less desirable grasses and brush to take their place. Overgrazing by cattle and other animals compacts the surface soil and increases the amount of bare ground, thereby increasing runoff and soil erosion. More recently, man has increased production on rangeland through brush management, range seeding to suitable grasses, and grazing systems that increase or maintain the quality of vegetative cover on the soil.

Relief

Relief, or topography, affects soil formation through its influence on drainage, erosion, and plant cover. The degree of development of a soil profile depends on the amount of water that enters the soil, provided that other factors of soil formation are equal. Soils on nearly level slopes absorb more rainfall. Erosion is less of a hazard on these soils because there is minimum runoff. These soils show greater profile development than the soils on steep slopes. Soils on steep slopes can erode away nearly as fast as they form.

Time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. Commonly, hundreds or thousands of years are required for the formation of well-defined genetic horizons.

Genetically, the soils in Webb County range from very young to old. Differences in age can be noted in the profile of the soils.

Rio Grande soils are very young. They formed in a recent flood plain and consist of unaltered or only slightly altered alluvial sediments.

Old soils are generally nearly level to gently sloping and are in stable upland positions on the landscape. Delmita soils are old. Calcium carbonate has been leached from the upper part of the profile and has accumulated below as a layer of cemented caliche. Also, clay has been translocated from the upper part of the profile to the subsoil.

Parent Material

Parent material is the unconsolidated organic and mineral material in which a soil forms. It determines the chemical and mineral composition of the soil. In Webb County, most of the soils formed in residuum of limestone, sandstone, caliche, marl, or shale, in ancient or recent alluvium, and in ancient marine deposits.

The shallow soils are on slopes where erosion has kept pace with soil development. The main shallow soils in the county are Cuevitas, Dilley, Jimenez, Nido, Quemado, Randado, Verick, and Zapata soils. The Dilley, Nido, and Verick soils are underlain by sandstone; the other soils are underlain by caliche.

Deep and moderately deep soils, for example, Catarina, Maverick, Montell, and Viboras soils, formed in calcareous clays and shaley clays. The Delmita soils formed in loamy sediment over thick beds of caliche. Copita and Duval soils formed in loamy sediment over sandstone. The Aguilares, Moglia, and Palafox soils formed in material that ranged from loamy to clayey.

Lagloria, Laredo, and Rio Grande soils formed in recent alluvium along the Rio Grande. These soils are deep and exhibit varying degrees of maturity.

Much of the parent material in the county contains gypsum and other salts. As a result, many of the soils are saline to some degree. Aguilares, Arroyada, Brundage, Catarina, Moglia, Montell, Palafox, and Viboras soils contain salts derived from the parent material.

Soil Horizon Differences

This section briefly discusses horizon nomenclature and the processes responsible for horizon development.

The action and interaction of the five soil-forming factors are recorded in the soil profile. Generally, a soil profile shows a succession of layers, or horizons, from the surface down to the parent material. The horizons differ in from one another in one or more properties such as thickness, color, texture, structure, consistence, porosity, or reaction.

Most profiles consist of three major horizons, designated A, B, and C. The A horizon is the surface layer, the B horizon is the subsurface layer, and the C horizon is the bedrock layer. In some young soils, a B horizon has not developed. Other soils are so mature that a Bkm, or indurated calcium carbonate horizon, is present. Several processes are involved in the formation of these horizons. In Webb County, the main processes are leaching and accumulation of calcium carbonate, soluble salts, and bases, and the formation and translocation of silicate clay minerals.

Most of the organic matter accumulates in the A horizon of a soil. The soils in Webb County range from low to high in content of organic matter. Nueces soils have a sandy A horizon that is low in organic matter. Tela and Laredo soils have a loamy A horizon that is high in organic matter.

The B horizon lies immediately below the A horizon. The B horizon may be either a horizon of maximum accumulation of dissolved or suspended materials, such as iron oxides or clay, that have been translocated from overlying horizons, or it may be an altered horizon that shows distinct structure but no evidence of clay translocation

or accumulation. A B horizon that has significant amounts of clay accumulation is called a Bt horizon. The Bt horizon commonly is firmer than the horizons immediately above and below, and it commonly has blocky structure. A subsurface layer that has distinct structure and little evidence of clay or other accumulation is called a Bw horizon. The Brundage and Brystal soils have a distinct Bt horizon; the Laredo soils have a Bw horizon.

The C horizon is relatively little affected by the soil forming process, but it can consist of material modified by weathering. The Lagloria and Rio Grande soils have a C horizon.

Surface Geology and Parent Material

Charles Mardirosian, geologist, Laredo, Texas, helped prepare this section.

Webb County is in the West Gulf Coastal Plain section of the Coastal Plains province of the United States (8). The surface consists of consolidated and unconsolidated sedimentary and eolian deposits. These surface sedimentary rocks dip gently toward the Gulf of Mexico. They range in age from Holocene, less than 5,000 years old, to Eocene, between 38 and 54 million years old. The eolian sediments are Holocene and Pleistocene and range from less than 5,000 years to more than 20,000 years in age.

The 13 geologic designations used in this section mainly follow the latest geologic maps of the region (15). The map units mentioned are those on the general soil map. Some soils cannot be uniformly correlated with a specific geologic unit because the soils do not fully match any of the available versions of the local geology (7, 15). Nevertheless, the differences have a direct effect on the genesis of the soils.

One example of a difference between parts of the survey area is that in the southeastern part of the county, wind action has reworked the older sediments by shifting and redistributing the surface materials. The wind action has blurred some of the older sedimentary deposits and some contacts between formations.

Other factors that affect soils are the low rainfall and high evaporation rate in the county. This combination leads to a retention and accumulation of calcium carbonate and soluble salts in the soil and tends to enhance similarities in soils despite differences in age.

In addition, fluvial sediments that are similar in age, such as Holocene alluvium, vary widely in composition throughout the county. Along the Rio Grande, the Holocene alluvium is predominantly silt, but along some of the tributaries of the Nueces River, the Holocene alluvium is predominantly clay. The exact nature of the Holocene alluvium and of the Pleistocene fluvial terrace deposits in the county is highly dependent on the origin of the sediment.

The Holocene alluvium and Pleistocene fluvial terrace deposits along the Rio Grande were the parent materials for the Lagloria-Rio Grande general soil map unit. In Webb County, the surface sediment in the areas of this map unit is mainly silt. Subsurface beds contain gravel and sand.

The Holocene alluvium, in which the Rio Grande soils formed, is the youngest parent material in the county. The sediment was deposited as point bars, levee ridges, and elongated flood plains.

By contrast, the older Pleistocene fluvial terrace deposits, in which the Lagloria soils formed, consist of prehistoric flood plains bordered by bluffs that are the remnants of an older course of the Rio Grande.

The Holocene alluvium or the Pleistocene fluvial terrace deposits affect every general soil map unit in the county except the Nueces-Delfina map unit. The Brundage, Catarina, and Montell soils formed in these parent materials in areas away from the river. Again, the nature of the parent materials varies depending on their origin.

The South Texas Sand Sheet is the next oldest geologic unit after the Holocene alluvium. This geologic unit covers part of the southeastern corner of the county and underlies the major part of the Nueces-Delfina general soil map unit and minor parts of the Delmita-Randado-Cuevitas general soil map unit.

The Sand Sheet deposits overlie and conceal part of the Goliad Formation. The Sand Sheet within Webb County consists of smooth sheet deposits, blowouts, and low, irregular, longitudinal stabilized dunes. The dunes and blowouts were probably active during recent droughty periods as well as during the variable climate of the Pleistocene. The Sand Sheet deposits consist of fine to medium quartz sand.

The Uvalde Gravel (Pleistocene or Pliocene) is the next geologic unit in age after the Pleistocene fluvial terrace deposits. This unit lies unconformably over the geologic units in the western half of Webb County and underlies a major part of the Maverick-Jimenez-Quemado general soil map unit and minor portions of the Copita-Verick, Catarina-Maverick-Palafox, Duval-Brystal, Montell-Moglia-Viboras, and Catarina-Maverick-Moglia general soil map units.

The Uvalde Gravel consists of gravel and conglomerate that is, in most places, cemented by caliche. Deposits are found on interstream divides and on the cap of hills (10). Pebbles consist of vein quartz, quartzite, chert, jasper, and silicified wood. The source material for the Uvalde Gravel is believed to be the Ogallala Formation of the Llano Estacado or material deposited concurrently with the Ogallala Formation. The ultimate source is the Southern Rocky Mountains in New Mexico (5).

The gravel was laid down as gravel beds by meandering rivers on an erosional surface. At the time of deposition, the Uvalde sediments were at the bottom of river valleys. The gravel protected the valley floor against rapid erosion. Adjacent highlands, without the gravel cover, were more rapidly eroded, resulting in a reversal of the original topography (5).

The Goliad Formation (Pliocene) is the next oldest geologic unit. It outcrops in the southeastern corner of the county and underlies the Delmita-Randado-Cuevitas general soil map unit and part of the Nueces-Delfina general soil map unit. Wind action has caused the surface to have some degree of northwest trending eolian lineation.

This geologic unit consists mainly of caliche, sand, and gravel. The gravel is in the lower strata of this formation. Much of the coarse material, where exposed, displays bedding (including considerable cross-bedding) of fluvial or alluvial fan origin. The origin of the calcium carbonate in the thick caliche mantle of the Goliad Formation is not clearly understood. Most of it is assumed to be transported to this formation as a component of eolian sediments. It was subsequently translocated into the upper part of this formation (4).

Much of the surface of the Goliad Formation shows a fracture-controlled karstic or solutional pattern that has many undrained depressional areas. This suggests, at least locally, that the rate of caliche accumulation is less than the solution rate (3,9).

The Fant Tuff Member (Miocene) of the Catahoula Formation outcrops in a band along the eastern edge of the Goliad Formation in the county. This geologic unit underlies parts of the Aguilares-Montell, Hebbronville-Brundage-Copita, and Delmita-Randado-Cuevitas general soil map units.

This geologic unit consists of tuff, sandstone, and claystone. The sediments were deposited during a period of volcanic activity when continental sands, clays, and pyroclastic materials were picked up by streams and concentrated in depositional areas assumed to be ancient coastal or bay nearshore regimes (10).

The Frio Formation (Oligocene) outcrops in a band below the Fant Tuff Member in the eastern part of Webb County. This geologic unit underlies part of the Aguilares-Montell, Hebbronville-Brundage-Copita, and Catarina-Maverick-Moglia general soil map units.

The Frio Formation consists of dark greenish gray clay, sandy clay, and gypsum. The origin of these sediments appears to be nonmarine continental and nearshore deposits (10).

The Jackson Group (Eocene) is below the Frio Formation stratigraphically and makes up the major part of the parent material of the Montell-Moglia-Viboras, Aguilares-Montell, Catarina-Maverick-Moglia, and Hebbronville-Brundage-Copita general soil map units. This geologic unit outcrops in a north-south belt across the eastern part of the county.

The Jackson Group consists mainly of clay, sandy clay, sandstone, and volcanic ash. Clay units are commonly bentonitic and grade laterally into ashy sandstone. Opalized and silicified wood are common. The origin of these strata is a series of marine, brackish water, nearshore, and continental deposits (10).

The Yegua Formation (Eocene), the next oldest formation, outcrops in a north-south belt across the central part of the county. The Montell-Moglia-Viboras general soil map unit is in this area, as are parts of the Catarina-Maverick-Moglia, Hebbronville-Brundage-Copita, and Copita-Verick general soil map units.

This geologic unit consists of gray to red clay, sandy clay, and thin beds of sandstone. The Yegua Formation is essentially a piedmont, coastal, alluvial fan built up by the coalescing of stream levees and deltas (10). The southeastern part of the Yegua in Webb County in the area of the Hebbronville-Brundage-Copita general soil map unit appears to have a considerable quantity of eolian deposits on the surface. The sands are similar to those of the adjacent Jackson Formation. These areas have a northwest trending eolian lineation.

The Laredo Formation (Eocene), below the Yegua stratigraphically, outcrops in a north-south belt across the central part of Webb County. The major parts of the Duval-Brystal and Copita-Verick general soil map units and small parts of the Montell-Moglia-Viboras and Catarina-Maverick-Moglia general soil map units are in this area.

This geologic unit consists primarily of sandstone and clay that has minor beds of marl and limestone. The lower strata are dominantly sandstone; the clay beds are mainly in the upper strata. During this epoch, continental, beach, littoral, marine, and palustrine conditions alternated (10). The formation contains oyster beds and abundant marine fossils.

The El Pico Clay (Eocene), below the Laredo Formation stratigraphically, outcrops across the western part of the county. Most of the Catarina-Maverick-Palafox general soil map unit is in this area, as are minor parts of the Maverick-Jimenez-Quemado and Copita-Verick general soil map units.

This geologic unit consists of clay, fine-grained sandstone, and coal. The sediments are primarily clay. The El Pico Clay is largely a continental fluvial deposit laid down by meandering and shifting rivers on a flat coastal plain. Toward the Gulf of Mexico, these rivers merged with shallow water beds of marshes and bays. Another part of the El Pico Clay consists of delta deposits in shallow waters (10). In the past, cannel coal was mined from the Santo Tomas bed in this area.

The Bigford Formation (Eocene), the next geologic unit in age, outcrops in a north-south band in the western part of Webb County. Parts of the Copita-Verick and Maverick-Jimenez-Quemado general soil map units are in this area.

This geologic unit consists of sandstone and minor lenses of clay and shale. These sediments are continental deposits laid down by streams that dropped their load on a flat coastal plain, thus building up a broad alluvial apron all along a coastline (10). This formation is a major aquifer.

The Indio Formation (Eocene) is the oldest geologic formation in the county and outcrops at the western tip of Webb County. The Copita-Verick general soil map unit is in this area.

This geologic unit consists of sandstone, shale, and lignite. These sediments were deposited in a transgressing sea that began with beach deposits and ended with deeper water deposition (10).

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. Soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit. The grazing equivalent of a 1,000 pound cow; used to express stocking rates as the number of acres per animal unit. Sometimes used to identify the amount of forage needed to feed an animal unit for a certain period of time.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Browse. The leaves, tender twigs, and fruit of woody plants on which livestock and wildlife feed.

Brush. A growth of shrubs or small trees.

Brush control. The practice of suppressing or killing one or more kinds of brush by a variety of mechanical, chemical, and biological methods or by prescribed burning. The general purpose of brush control is to reduce plant competition for sunlight, water, and nutrients so that livestock or wildlife forage can be more productive.

Brush control patterns. The purposeful positioning of brush controlled areas within untreated areas of brush so as to increase the proportion of edge area between brushy cover and open space; most often done to improve or maintain wildlife habitat.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Canopy. The cover or density of brush or tree growth, commonly measured by the percentage of ground that would be shaded by the brush or tree growth at noon.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The ability of a certain area to support or meet the needs of a certain number of animals on a sustained long-term basis while maintaining or improving the quality of the area. Generally expressed as the number of acres needed per animal.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.
- Chaparral.** A plant community characterized by an understory of grasses and forbs and a moderate canopy of low brush.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
- Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Climax vegetation.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
- Coarse fragments.** If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.
- Cobblestone (or cobble).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.
- Complex slope.** Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.
- Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.
- Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.
- Continuous grazing.** The practice of allowing livestock to graze on a given area all year long, year after year. Eventually, livestock graze out the better plants, and range condition deteriorates.
- Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover. The protective concealment that wildlife need in order to inhabit an area and to feel safe from humans and other predators. Cover is most commonly provided by different kinds and amounts of vegetation.

Cow-calf operation. A cattle enterprise in which a breeding herd of cows is grazed and bred, and weaned calves are produced for market.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently

ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Edge area. The border between dense brushy vegetation and more open areas. It is the preferred habitat of several kinds of wildlife.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains.

Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Grazing management. The regulating of the intensity, duration, and pattern of grazing practiced in a given area.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; the environmental requirements that must be met in order for the plant or animal to live in an area.

Harvest management. The regulating or controlling of a game species as to the age, sex, and number of animals to be legally harvested during a season.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two

hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Microrelief. Minor surface configurations of the land, such as low mounds and shallow depressions.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands as water is absorbed and contracts as water evaporates. It has a high cation-exchange capacity and is plastic and sticky when wet.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*, size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Open grassland. Land on which the plant cover is dominated by grasses. Some forbs are present, but the area supports only a very thin canopy of brush and trees.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Overgrazing. The practice of allowing more animals to graze an area than the existing forage can support. Overgrazing allows the best and most desirable plants to be grazed too severely, reducing plant vigor and impairing future forage production. Prolonged overgrazing results in range deterioration.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called “a soil”. A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Perennial plant. Any long-lived grass, forb, or woody plant that has a lifespan of three or more years.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plant community. A mixture of at least several different kinds of plants growing in association on a certain area.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Prescribed burning. The deliberate use of fire in order to accomplish a specific objective; commonly to suppress brush regrowth and to improve the palatability of certain range forages. The area to be burned is predetermined and the intensity of the fire controlled.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper stocking. Regulating the intensity of grazing by controlling the number of animals on a given grazing unit, in order to protect the soil and maintain or improve the quantity and quality of desirable vegetation.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range deterioration. The process by which range plant community slowly changes from the climax plant community to a community of plants that are much less desirable from a grazing standpoint. Range deterioration most commonly results from heavy and continuous grazing by domestic livestock, but it can be accelerated by drought, frequent wildfires, and overpopulation by wildlife.

Range management. The discipline based on ecological principles regarding the use of rangeland resources.

Range seeding. The mechanical application of native or introduced seed to rangeland that has been depleted or mechanically disturbed. Range seeding is used either for livestock and wildlife forage or for erosion control.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Riparian savannah. A grassland that lies adjacent to a drainageway and that supports moderate brush and tree canopies.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Semiopen grassland. Land on which the dominant plant cover is grasses. Some forbs are present, and the area supports thin to moderate brush canopies.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

	SAR
Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stocker operation. A kind of cattle operation in which post-weaned calves or yearlings are grazed for the purpose of gaining weight for sale in less than a year.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer”, or the “Ap horizon”.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse”, “fine”, or “very fine”.

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Understory. The vegetation that grows on or near the ground under the canopy; commonly grasses, forbs, halfshrubs, and young brush.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wildlife habitat management. A discipline based on recognizing and meeting the food, cover, and water requirements of one or more wildlife species.

Tables

The tables in this soil survey contain information that affects land use planning in this survey area. More current data tables may be available from the Web Soil Survey at the Tabular Data tab.

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